TESTING A MULTICOMPONENT MODEL OF READING COMPREHENSION

FOR SEVENTH- AND EIGHTH-GRADE STUDENTS

A Dissertation

by

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ABSTRACT

Reading is a complex construct with multiple components that have been theorized and empirically tested. Two multicomponent reading comprehension models were tested in this study to extend understanding of the relation of components skills and to extend prior research by adding a new component of motivation.

A battery of reading measures were completed by 172 seventh- and eighth-grade students that consisted of reading comprehension, vocabulary, background knowledge, inference, motivation, and sentence comprehension fluency. This study examined a full sample of students as well as a subset of students identified as struggling readers for those scoring less than the 25th percentile on comprehension.

Two models were tested for best fit for the Modified DIME and the Multicomponent Model of Reading Comprehension (MMRC). The Modified DIME Model accounted for 63.1% of total variance in reading comprehension. The MMRC also accounted for 63.5% of total variance in reading comprehension after motivation was included as a component of comprehension. Consistent with prior research, findings corroborated the direct influence of multiple components on reading comprehension; most notably vocabulary and the ability to make inferences. Vocabulary provided the largest direct and overall effect in both models. In the Modified DIME Model, vocabulary made the largest direct (.428) and overall contribution (.654) to reading comprehension; vocabulary also held the largest influence for the MMRC both directly (.429) and in overall influence (.653) to reading comprehension. Inference-making was

the second-largest direct and overall contributor for both the Modified DIME (.398) and the MMRC (.390). Findings were consistent for both struggling and typical readers in both models. In this study, there was no direct path from motivation to comprehension; however, when direct and indirect relationships were combined, motivation became the third largest contributor to reading comprehension (.186). Motivation was significantly and directly related to comprehension for typical readers (.171, $p < .05$), but not for those who struggle to read (-.043, $p > .05$). The findings suggest typical readers with higher motivation perform better on reading comprehension tasks, but there is no direct relationship for struggling readers. Limitations of the study and implications for future research are also discussed.

DEDICATION

I dedicate my dissertation work to my son, Cole, my husband, Josh, and Aunt Jeanne and Uncle Jeeper.

Cole Bear, you were both the reason I delayed my graduation and persisted in its completion. Of all of my accomplishments- you are my greatest.

Josh, thank you for allowing me this opportunity to contribute to our family's future. The sacrifice you made to drop everything and move to Aggieland ended up being one of the highlights in my life. Thank you for your patience and encouragement. I love you.

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TABLE OF CONTENTS

	Page
ABSTRACT	ii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
TABLE OF CONTENTS	viii
LIST OF FIGURES	x
LIST OF TABLES	xi
CHAPTER I INTRODUCTION	1
Multicomponent Models of Reading	3
Purpose of Study	10
Motivation Defined	11
Components of Motivation	12
Empirical Base of Motivation	14
Research Questions	15
CHAPTER II LITERATURE REVIEW	16
Path Analysis	17
Twelve Paths of the DIME Model	17
Components and Their Relation to Reading Comprehension	19
Proposed Paths	26
CHAPTER III METHODS	30
Research Design and Context	30
Participants	30
Materials and Measures	31
Procedure	35
CHAPTER IV ANALYSES AND RESULTS	36
Descriptive Analysis	36
Data Analysis	37

Page

Research Question 1 38
Research Question 2 45
Research Question 3 54

CHAPTER V DISCUSSION AND CONCLUSION 57

Components of Reading Comprehension and their Relation to the Modified DIME and Multicomponent Model of Reading Comprehension 59
Limitations, Areas of Future Research, and Conclusion 68

REFERENCES 74

APPENDIX 92

LIST OF FIGURES

FIGURE		Page
1	The DVC Triangle	9
2	The DIME Reading Comprehension Model	18
3	Modified DIME Model 2	27
4	Modified DIME Model 3	28
5	Multicomponent Model 1 of Reading Comprehension	28
6	Multicomponent Model 2 of Reading Comprehension	29
7	Modified DIME Model 2 with Path Coefficients	42
8	Modified DIME Model 3 with Path Coefficients	43
9	Multicomponent Model 1 of Reading Comprehension with Path Coefficients	48
10	Multicomponent Model 2 of Reading Comprehension with Path Coefficients	50
11	Comparison of Typical and Struggling Readers for Modified DIME Model	55
12	Comparison of Typical and Struggling Readers for MMRC	56

LIST OF TABLES

TABLE Page

1 Comparison of Reading Model Components ... 5

2 The DIME Reading Comprehension Model Findings ... 19

3 Inference Measure Based on "Barrio Boy" and "A Portrait of Americans" ... 34

4 Descriptive Analyses of Measures of Raw Scores ... 36

5 Model Component Correlations (N = 172) ... 38

6 Fit Indices for Modified DIME Models ... 41

7 Modified DIME Model 2 Path Coefficients ... 44

8 Modified DIME Model 3 Path Coefficients ... 44

9 Cumulative Effects for the Modified DIME Model ... 45

10 Fit Indices for Multicomponent Models of Reading Comprehension ... 47

11 Multicomponent Model 1 of Reading Comprehension Path Coefficients ... 47

12 Multicomponent Model 2 of Reading Comprehension Path Coefficients ... 49

13 Cumulative Effects for the MMRC ... 52

14 Comparison of Component Relationships between Modified DIME and MMRC ... 53

CHAPTER I

INTRODUCTION

Two simple lines from a children's book epitomize the spirit and predicament of the state of reading in today's schools: "The more that you read, the more things you will know. The more that you learn, the more places you'll go" (Dr. Seuss, 1978, p. 27). Reading is a primary method of gaining knowledge. However, many do not possess the skills and strategies to read more and learn more. Correlational research suggests that students who struggle academically, especially with reading, are less likely to attend postsecondary school, less likely to make as much money as their peers with better literacy skills and higher education, and more likely to experience unemployment (Carnevale, 2000; OECD, 2007).

For many students in the United States, reading proficiency declines as they progress to later grades where reading comprehension becomes a prerequisite for content-area learning (Common Core State Standards Initiative, 2010; RAND Reading Study Group, 2002). Reading comprehension is the ability to extract and construct meaning from text, and is a prerequisite for accessing content-area curriculum (RAND Reading Study Group, 2002, p. xii). Biancarosa and Snow (2006) viewed reading comprehension as both the central goal and obstacle for adolescent readers. Specifically, while the purpose of reading for adolescents is primarily to acquire information from text, text complexity poses many challenges (Rampey, Dion, & Donahue, 2009). To be successful in content-area courses, demonstrate proficiency on high-stakes reading assessments, and read independently for entertainment, older readers must be able to read narrative and expository text fluently with comprehension (Scammacca et al., 2007). This decline in comprehension begins as early as fourth grade. The "fourth-grade slump" is a well-known reference to the fact that many students begin to struggle with reading as they encounter increasingly complex informational text (Chall, 1983). While it begins in fourth grade, this decline becomes steeper as students advance beyond late elementary grades (Chall, Jacobs, & Baldwin, 1990). Indeed, without intensive intervention, the fourth-grade slump may turn into what some call "the eighth-grade cliff" (Sanacore & Palumbo, 2009, p. 69).

The National Assessment of Educational Progress ([NAEP]; Rampey et al., 2009) reported a disturbing finding: One-fourth of 8^{th}- and 12^{th}-grade students read at or below Basic level. NAEP defines "Basic" for eighth grade as the ability to "locate information; identify statements of main idea, theme, or author's purpose; and make simple inferences from texts. In addition, students should be able to interpret the meaning of a word as it is used in the text. Students performing at the Basic level should also be able to state judgments and give some support about content and presentation of content" ("Grade 8," para. 1). Twelfth graders at the Basic level are expected to "make inferences, develop interpretations, make connections between texts, and draw conclusions; and they should be able to provide some support for each. They should be able to interpret the meaning of a word as it is used in the text" ("Grade 12," para. 1). NAEP's finding that a quarter of America's 8^{th} and 12^{th} graders are not proficient at these reading tasks indicates that multiple components are implicated in reading comprehension.

The RAND Reading Study Group (2002) described reading comprehension as an interactive process of reader characteristics (e.g., motivation, memory, inference-making, and background knowledge), type and difficulty of text, the task demonstrating understanding, and the contextual factors specific to individual learners (e.g., school culture, curriculum, and teacher-student relationships). The characteristics, attributes, and skills students bring to the text and task have been a primary focus as reading theorists and researchers seek to understand factors associated with comprehension. Six essential component skills and processes demonstrated by proficient adolescent readers include (a) reading fluency, (b) vocabulary knowledge, (c) background knowledge, (d) higher-level reasoning and thinking skills, (e) cognitive strategies specific to reading comprehension, and (f) motivation and engagement (Torgesen et al., 2007). Although not a comprehensive list of reading comprehension components, these six essential skills are present in many multicomponent models of reading comprehension.

Multicomponent Models of Reading

To understand reading comprehension, and in particular the reading difficulties of struggling readers, researchers have begun to examine models of reading comprehension that take into account the direct and mediating role of multiple components. Multiple methods have been used to explore the relations of components and reading outcomes including structural equation modeling, meta-analyses, and correlational research. More specific to this study, structural equation models allow researchers a better understanding of the comparative strengths of relationships among components. Following is a brief review of the prevalent theoretical models of reading comprehension, methods of analyses, and a summary of the findings of studies that have examined the relationships among the multiple components and reading outcomes.

DIME Model of Reading Comprehension. The Direct and Inferential Mediation Model of reading comprehension (DIME) developed and tested by Cromley and Azevedo (2007) measured the direct and indirect relationships of five components (background knowledge, word fluency, vocabulary, strategy use, and inference-making) to reading comprehension. Cromley and Azevedo hypothesized direct effects on comprehension from background knowledge, strategy use, inference-making, word reading, and vocabulary as well as indirect effects of strategy use, inference-making, word reading, and vocabulary. These researchers also hypothesized that background knowledge and word reading were correlated but would not directly affect each other.

After testing multiple variations of the structural equation model, Cromley and Azevedo (2007) reported that the DIME model explained 66% of the variance on a standardized reading comprehension measure for 175 ninth-grade students. According to this model, vocabulary and background knowledge made the largest direct contributions to comprehension, followed by inference, word reading, and strategies. Cromley and Azevedo also found struggling readers had difficulty with all of the measured components of reading comprehension and performed poorly on all measures compared to proficient readers.

In addition to Cromley and Azevedo's DIME model, numerous theoretical models have been proposed to explain the complex process of comprehension. Table 1 summarizes the primary components of each model and compares their emphases.

Although many of the components are applicable to early readers, the following review is focused specifically on components for adolescent readers.

Table 1. Comparison of Reading Model Components

Model	Components of Reading Comprehension
Direct and Inferential Mediation Model (Cromley & Azevedo, 2007)	• Background knowledge • Inference • Strategies • Vocabulary • Word reading
Simple View of Reading (Gough & Tumner, 1986)	• Decoding • Linguistic comprehension • (Vocabulary embedded)
Component Model of Reading (Aaron, Joshi, Boulware-Gooden, & Bentum, 2008; Carreker & Joshi, 2010)	• Domain 1: Cognitive Components (word recognition, decoding, and comprehension) • Domain 2: Psychological Components (e.g., motivation and interest) • Domain 3: Ecological Components (e.g., peer influence and classroom environment)
Construction Integration Model (Kintsch, 1988, 1994, 1998; Kintsch et al., 1993)	• Background knowledge • Inference • Strategies • Vocabulary • Word reading • Working memory

Table 1. Continued

Model	Components of Reading Comprehension
Verbal Efficiency Theory (Perfetti, 1985, 1988, 1989; Perfetti & Hart, 2001)	• Inference • Strategies • Vocabulary • Word reading • Working memory
The DVC Triangle (Perfetti, 2010)	• Decoding • Vocabulary
The RAND Model of Reading Comprehension (RAND, 2002)	• Reader (attention, memory, critical analysis ability, inferencing, visualization, motivation, knowledge, and personal experiences) • Text (text wording, units of meaning, and mental models or the way information is processed for meaning) • Activity (purpose, task, decoding, linguistic and semantic processing, comprehension monitoring) • Context (classroom, sociocultural environments)

Simple View of Reading. According to Gough and Tunmer's Simple View of Reading ([SVR]; 1986), reading comprehension requires both the ability to decode words and listening linguistic comprehension. Gough and Tunmer (1986) define decoding as the translation of written text to language and linguistic comprehension as the integration and interpretation of word information, sentence structure, and discourse, similar to listening comprehension. Readers should not only be able to decode writing, but also understand what was read and be able to answer questions about it. According to the SVR, "reading equals the product of decoding and listening comprehension, or $R = D \times C$, where each variable ranges from 0 (nullity) to 1 (perfection)" (Gough & Tunmer, 1986, p. 7). Gough and Tunmer's formula implies that if there is no decoding ($D = 0$), then reading has not taken place, $R = 0$, because $R = 0 \times C$. Similarly, if a student can decode but does not comprehend what is said, $C = 0$, and reading has not occurred, $R = 0$.

The SVR was recently tested and validated through a meta-analysis of 20 studies involving preschool to fourth-grade students (Florit & Cain, 2011). Results of the meta-analysis indicated strong correlations between reading comprehension and decoding accuracy (R = .73; 95% CI [.70–.75]) and reading comprehension and linguistic comprehension (R = .72; 95% CI [.69–.74]) for English-speaking readers ages 8–11. Additionally, SVR explained a significant amount of variance in reading comprehension for 271 fourth-, seventh- and ninth-grade readers, with additional findings that the explained variance decreased in higher grade levels (Tilstra, McMaster, Van den Broek, Kendeou, & Rapp, 2009). Catts, Adolf, and Weismer's (2006) findings also supported the SVR model among 182 eighth graders, and further suggested that a lack of advanced inference-making ability for those with poor comprehension may explain additional reading difficulties.

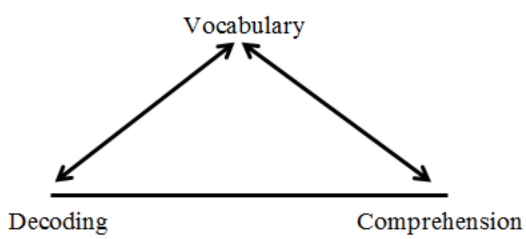
Component Model of Reading Comprehension. More recently, researchers have developed an extension on Gough and Tunmer's SVR, called the Component Model of Reading ([CMR]; Aaron et al., 2008). Specifically, Joshi and Aaron (2000) revised the SVR formula to account for the variance explained by the speed of processing, resulting in $R = D \times C + S$. The CMR further extended the SVR by including other factors such as psychological and ecological components that contribute to reading difficulty. The CMR consists of three domains, cognitive, psychological, and ecological, which are associated with the reader, and which target the cause of reading difficulty and provide instruction for a specific component. When Aaron and colleagues (2008) tested Domain 1 of the CMR with 204 younger readers from second to fifth grades, two of the three components, decoding and listening comprehension, were validated in this sample. A Fisher's Z-test showed the extension of SVR by adding speed of processing resulted in 57.76% explained variance ($p < .000$), compared to an SVR replication with 47.61% explained variance ($p < .000$). Speed of processing alone accounted for 10.24% of explained variance ($p < .05$).

Construction Integration Model. Walter Kintsch's (1988, 1994, 1998; Kintsch et al., 1993) Construction Integration Model (CI) is a multiphase reading comprehension model that includes both a construction phase and an integration phase. The construction phase involves integrating the text with the reader's background knowledge and the dynamic activation of word meanings (vocabulary) gained from decoding the text that can be aided through the use of reading strategies. For the integration phase, readers integrate what was previously constructed using inference-making with personal experiences and background knowledge to create new understanding.

Verbal Efficiency Model. According to Perfetti's Verbal Efficiency (VE) Theory (Perfetti, 1985, 1988, 1989; Perfetti & Hart, 2001), reading comprehension requires more than word recognition accuracy. According to these researchers, reading comprehension begins when readers recognize words with nearly effortless automaticity. That is, proficient readers do not have to devote finite attentional resources to lower-level cognitive processes (such as decoding) and can, therefore, focus their mental working capacity on comprehension. The more inefficient a reader is with word reading and automaticity, the fewer mental resources are available for comprehension, vocabulary, strategy use, and inference-making.

The DVC Triangle. Perfetti recently proposed a three-component reading comprehension model called the Decoding Vocabulary Comprehension (DVC) Triangle, or “the golden triangle of reading skills” (Perfetti, 2010, p. 291). In this model, causal relationships within reading comprehension are theorized using two components of reading comprehension: decoding and vocabulary. In a schematic of the model (Figure 1), direct and bidirectional arrows connect decoding with vocabulary as well as vocabulary with comprehension. The straight line with no arrows between decoding and comprehension suggests that indirect effects of decoding on reading comprehension are mediated by vocabulary.

Figure 1. The DVC Triangle.



RAND Model of Reading Comprehension. The RAND Reading Study Group’s (2002) multicomponent model of reading comprehension covers three interrelated domains (reader, text, and activity) all within the sociocultural context of the classroom, school, and/or home environment. Each reader brings his or her own experiences, motivation, critical thinking ability, memory, and inference-making to the text. The text is comprised of numerous factors, including, but not limited to, the level of difficulty based on text wording and organization, type of text (e.g., print or electronic, narrative or expository), and linguistic structure. The activity, or purpose the reader has for reading the text, can be imposed either externally (e.g., by teacher assignment) or internally (e.g., wanting to assemble a desk).

Purpose of the Study

All the models reviewed for this study hypothesized that multiple components influence reading comprehension. While there is considerable convergence of components of reading comprehension among many of the theoretical models, limited research has tested the direct and indirect influence of components on reading comprehension with adolescents. Further, although many theories have been proposed, empirical research on direct and indirect influences of the various components on reading comprehension is limited. To address this gap in the knowledge base, the present study extended prior research in two primary ways.

First, this study aimed to extend our understanding of the relationship among components of reading comprehension by building on components of multiple models. We applied the direct and indirect mediation model methodology of Cromley and Azevedo (2007) and several common components including background knowledge, inference, and vocabulary. This study tested a modified DIME model that examined the relationship of reading comprehension components of ninth grade students to a sample of 172 seventh- and eighth-grade students. This DIME model was modified by the substitution of measures which also included sentence comprehension fluency. Second, despite recent progress in understanding the relational roles of components to reading comprehension, current multicomponent theoretical models have not empirically tested motivation as a contributing factor to reading comprehension. This study aimed to provide a coherent and parsimonious representation of the complex nature of and interrelationships among components. Specifically, it included and assessed the direct and indirect role of motivation within a reading comprehension model. Additionally, this study examined the relations of model components among proficient and less proficient readers who scored at or below the 25th percentile on the Gates-MacGinitie reading comprehension subtest to determine whether components differentially influenced reading comprehension.

Motivation Defined

As is true for reading comprehension, motivation is a complex, multifaceted construct with many contributing components that range from personal interest to self-efficacy. The components of motivation discussed in this study include self-efficacy, extrinsic and intrinsic motivation, and social motivation. With respect to academic tasks, Wigfield and Guthrie's (1995) definition of motivation focuses on the "the whys of behavior … the choices individuals make about which activity to do or not to do, their degree of persistence at the chosen activities, and the amount of effort they exert as they do the activity" (p. 14). Teachers often rank motivation as a primary component of reading comprehension (Hootstein, 1996; Veenman, 1984); however, motivation to read declines as students move beyond primary grades (Moje, Young, Readence, & Moore, 2000; Wigfield & Guthrie, 1997).

Components of Motivation

Self-efficacy. A commonly agreed-upon foundational component of motivation is self-efficacy, the self-evaluation of competence (Bandura, 1997) How one evaluates one's competence affects not only one's affective nature but also one's perseverance in tackling difficult tasks (Bandura & Locke, 2003). For example, motivated students are more likely to provide greater effort and persevere through a difficult task in spite of frustration or distraction (Larson, 2000; Maehr, 1984; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1996; Wigfield, 1994; Wolters & Rosenthal, 2000).

Self-efficacy among readers typically hinges on their beliefs of competence, often based on previous academic successes or failures; this is especially true for older readers (Harter, Whitesell, & Kowalski, 1992; Wigfield, 1994). Academic failure can influence students' views of competence (Parsons & Ruble, 1977; Stipek, 1984). When students feel incompetent as they read, they are less likely to persevere through difficult text and tasks.

Extrinsic and Intrinsic Motivation. Intrinsic motivation is "the desire to engage in behaviors for no reason other than sheer enjoyment, challenge, pleasure, or interest" (Lepper, Corpus, & Iyengar, 2005, p. 184). Readers who are intrinsically motivated read because they want to read; the desire to read lies within the reader. Alternatively, extrinsic motivation compels readers to engage in the text for external awards, such as grades, social approval, or tangible rewards like prizes or tokens. Often fueled by competition and the avoidance of punishment or negative consequences, extrinsic motivation, has been found to be weaker than intrinsic motivation (Carton & Nowicki, 1998; Deci & Ryan, 1985; Edwards, 1994; Fair & Silvestri, 1992).

Readers who are intrinsically motivated initiate reading and read independently regardless of classroom rewards. Wigfield and Guthrie (1997) reported that students who scored at the top of their motivation composite read almost three times as much as students who had the lowest motivation. Less-motivated readers are more likely to sidestep effortful thinking required by complex text (Guthrie & Solomon, 1997). Not surprisingly, intrinsic motivation has been found to predict classroom success (Gottfried, 1985, 1990).

Social Motivation. Reading is inherently a social activity. Even when text is read in solitude, it often can shape and influence the reader's social interactions and relationships (Bloome, 1983; Maybin & Moss, 1993).

The concept of reading being a social activity aligns developmentally with most adolescents who are becoming preoccupied with peer relationships (Gentry & Campbell, 2002). Because of classroom discussions, social motivation is often a driving force for reading. Text-based discussions are designed to engage students in meaningful opportunities to integrate and evaluate their understanding of information or text that was read. Text-based discussions also provide opportunity for "participatory dialogue" in large or small groups regarding a jointly-read text. Classrooms that are more discussion oriented display higher literacy growth than those in which discussion is less frequent (Applebee, Langer, Nystrand, & Gamoran, 2003; Kamil, Borman, Dole, Kral, Salinger, & Torgesen, 2008). Students who are socially motivated are also more likely to possess intrinsic motivation (Wentzel & Wigfield, 1998). In short, many students are intrinsically motivated because of the social aspect of reading, whether to participate with peers in discussion or to avoid embarrassment in class.

Empirical Base of Motivation

Kamil et al. (2008) reported a moderate level of empirical evidence for motivation and designated a focus on motivation as one of five recommendations for improving adolescent literacy based on 12 studies and two meta-analyses. Although the majority of research on motivation is correlational, motivation is considered a leading predictor of student school success and an important component of reading comprehension (Gottfried, 1985, 1990; Guthrie et al., 2004; Moje, 2000; Moje & O'Brien, 2001).

A decrease in reading motivation has been observed as students advance through their academic careers (Guthrie & Wigfield, 2000; McKenna, Kear, & Ellsworth, 1995; Snow & Biancarosa, 2003). The decline is particularly noticeable during the middle school years (Anderman & Young, 1994; Wigfield, 1994), and even more so for students who are struggling (Harter et al., 1992). The decrease in motivation might be attributed to increasing academic demands and level of text difficulty as content-area teachers assume students have mastered basic reading skills (Shanahan & Shanahan, 2008).

Recent research examining the contribution of motivation to reading comprehension is limited, and a reading comprehension model that includes the contributions of motivation to reading comprehension has yet to be developed. In this study, a measure of student motivation was included in the theoretical model, and its direct and indirect influence on reading comprehension examined.

Research Questions

The following research questions directed the study: (a) Which variation of Modified DIME Model of Reading Comprehension has the best fit for seventh-and eighth-grade students? (b) Which variation of the Multicomponent Model of Reading Comprehension has the best fit for seventh- and eighth-grade students? (c) Do the interrelationships among the reading comprehension components differ between struggling readers and typical readers?

CHAPTER II

LITERATURE REVIEW

Reading comprehension is a multicomponent process that has been articulated in a variety of models. While multiple components have been hypothesized and validated as separate correlates of reading comprehension, recent research has begun to examine the relative relation of components to comprehension when integrated into statistical models. Models that analyze and integrate multiple components of reading hold great promise to identify and prioritize factors most strongly related to reading comprehension.

To understand the relationships among these variables better, this study extended prior research based on the Direct and Inferential Mediation Model of reading comprehension ([DIME]; Cromley & Azevedo, 2007). While the current study contains components that are similar to the DIME Model, there are important differences. That is, building on the DIME Model methodology, this study examined the relationships between background knowledge and vocabulary with regard to seventh- and eighth-grade students' reading comprehension. In addition, instead of using a word-recognition measure comprised of letter and word identification and timed oral reading fluency (ORF), this study used a test of silent reading efficiency that incorporates both sentence-level fluency and comprehension. Additionally, this study incorporated and tested motivation as a component of reading comprehension. The purpose of this chapter is to review the empirical evidence of the interrelationships among the components of reading comprehension.

First, terminology and explanations of the path analysis used in the models will be provided. Next the DIME model and findings are discussed. Then the examinations of the relationships among the components of reading comprehension are presented with supportive literature. Finally, the proposed multicomponent model is provided.

Path Analysis

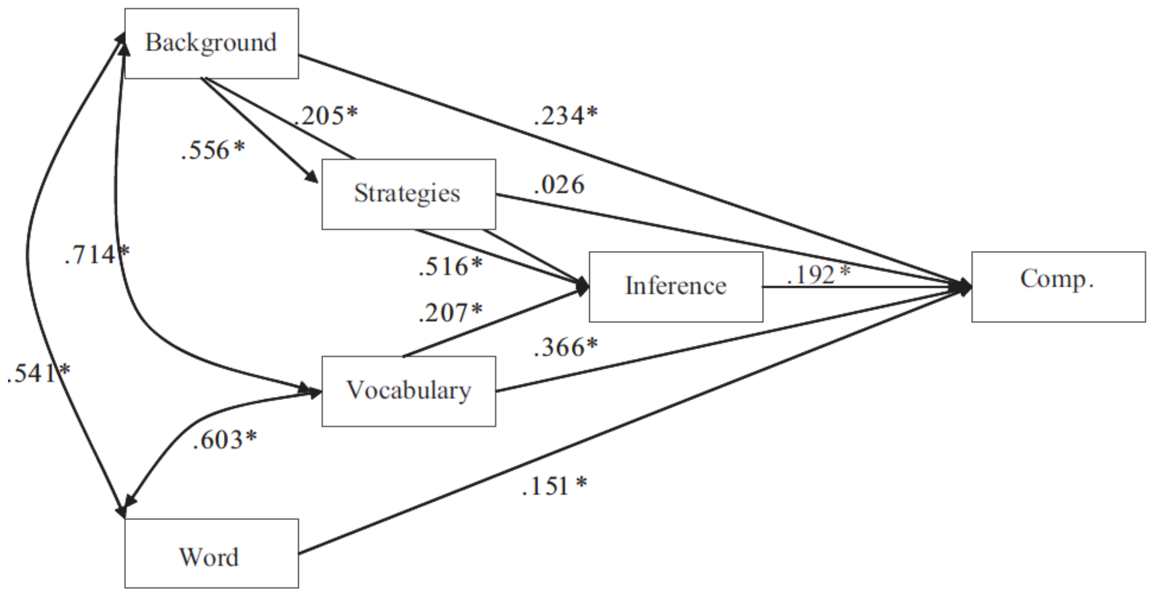
Also known as causal modeling, path analysis provides a visual and quantitative model of the interrelationships among variables. That is, based on an a priori theory, the researcher creates a model to test the best fit for the data. Path analysis uses specialized nomenclature; for example, independent variables are referred to as exogenous or upstream variables, and dependent or mediating variables are referred to as endogenous or downstream variables.

A set of symbols is used to represent causal relationships within path analysis. Rectangles signify observed variables that are directly measured by the researcher. Curved arrows symbolize a theoretical relationship, whereas unidirectional and bidirectional arrows indicate a direct causal link between variables. Lines without arrows indicate there is no direct path between variables; however, the variable may be a mediator between two related variables.

Twelve Paths of the DIME Model

Cromley and Azevedo (2007) tested the fit of four variations of the DIME reading comprehension model to data from ninth-grade students. The researchers hypothesized the direct and mediated relationships among five components of reading comprehension, including background knowledge, vocabulary, inference-making, strategy use, and word reading to reading comprehension (see Figure 2). Cromley and Azevedo's findings are also presented in Table 2.

Figure 2. The DIME Reading Comprehension Model.



** Statistical significance at the .05 level*
Note: Background = background knowledge, Word = word reading fluency, Comp = reading comprehension

Table 2. The DIME Reading Comprehension Model Findings

Path	Path description	Correlations	Statistically significant?
1	The direct effect of background knowledge on reading comprehension	.234	Y
2	The direct effect of background knowledge on strategy use	.556	Y
3	The mediated effect of background knowledge on inference-making through strategy use	.205	Y
4	The direct effect of strategy use on reading comprehension	.026	N
5	The direct effect of strategy use on inference-making	.516	Y
6	The direct effect of word reading on reading comprehension	.151	Y
7	The direct effect of vocabulary on inference-making	.207	Y
8	The direct effect of vocabulary on reading comprehension	.366	Y
9	The direct effect of inference-making on reading comprehension	.192	Y
10	The correlation of vocabulary and word reading	.603	Y
11	The correlation of vocabulary and background knowledge	.714	Y
12	The correlation of background knowledge and word reading	.541	Y

Components and Their Relation to Reading Comprehension

This study examined the relationship of background knowledge, motivation, vocabulary, inference-making, and sentence-level fluency with reading comprehension. Eight paths were modified from the DIME model (Cromley & Azevedo, 2007), and four additional paths were tested. Current research support for the relationships among components is discussed and followed with the proposed model and possible variations.

Direct paths to reading comprehension are discussed first, followed by direct paths between reading components, followed by indirect paths among components.

Background Knowledge and Reading Comprehension. In the 1980s, the impact of background knowledge on comprehension was widely studied based on schema theory. A schema is an organized set of understandings of knowledge that evolve with the addition of new information; schema theory proposes that readers use prior knowledge to understand and respond to what they read (R. C. Anderson, 1977; R. C. Anderson & Pearson, 1984; RAND Reading Study Group, 2002; Rumelhart, 1981). Schema theory espoused that "what you already know or don't know about a topic can greatly influence your comprehension" (McCormick, 1987, p. 303). That is, readers bring personal experiences to the text to make the reading meaningful and applicable to everyday life, thereby redefining their schemata. The unique background experiences and information each reader brings to the text improves or possibly impairs the reader's comprehension (McCormick, 1987; Pressley & Block, 2002).

In the DIME Model (Cromley & Azevedo, 2007), background knowledge was shown to have a direct effect (.234) on reading comprehension. Prior knowledge was also found to have indirect effects (.11) on reading comprehension mediated by strategy use and inference-making.

Sentence Fluency and Reading Comprehension. Students who struggle to read fluently report lower text comprehension because they expend extensive attentional resources on lower-level cognitive processes such as decoding fluently rather than on reading comprehension (Samuels, 1994; Stanovich, 1988). This is not surprising, since a high correlation has been documented between oral reading fluency and reading comprehension (L S. Fuchs, Fuchs, Hosp, & Jenkins, 2001; L. S. Fuchs, Fuchs, & Maxwell, 1988; Hosp & Fuchs, 2005; Paris, Carpenter, Paris, & Hamilton, 2005; Wayman, Wallace, Wiley, Tichna, & Espin, 2007); however, lower direct correlations have been documented for adolescent readers (Jenkins & Jewell, 1993; Shinn, Knutson, Collins, Good, & Tilly, 1992; Torgesen, Nettles, Howard, & Winterbottom, 2005). A lower direct correlation between reading fluency and text comprehension was also reported by Cromley and Azevedo (2007); however, the DIME model reported a statistically significant path coefficient of .151 between word reading and text comprehension.

This study modified the DIME's word identification path by analyzing data collected on the validated Test of Silent Reading Efficiency and Comprehension ([TOSREC]; Wagner, Torgesen, Rashotte, & Pearson, 2010). The TOSREC combines both sentence-level reading fluency and reading comprehension through verification questions about the truthfulness of the sentence. In a concurrent validity test of the TOSREC for first- through fifth-grade students, Johnson, Pool, and Carter (2011) found the high and statistically significant correlations (grade 1= .822, grade 2 = .831, grade 3 = .781, grade 4 = .324, and grade 5 = .798) of the TOSREC to oral reading fluency (ORF) for all but fourth grade in the fall administration. Similarly, Denton and colleagues (2011) reported comparable correlations of the TOSREC to ORF passage fluency (.61) for sixth, seventh, and eighth-grade students.

Vocabulary and Reading Comprehension. The relationship between vocabulary and comprehension has been widely studied and reported, and is especially important as students transition into secondary grades that place increasing emphasis on informational text (R. C. Anderson & Freebody, 1981; Hart & Risley, 2003; Hirsch, 2003; Kameenui, Carnine, & Freschi, 1982). There is a direct relationship between vocabulary and reading comprehension; readers must be able to understand the majority of words encountered to make sense of the text. Nagy and Scott (2000) reported that comprehension is contingent on understanding the meanings of 90-95% of words. One of the largest direct contributors to reading comprehension reported in the DIME Model is vocabulary (.366).Furthermore, vocabulary measures have been regarded as better predictors of reading comprehension than oral reading fluency (Espin & Foegen, 1996; Yovanoff, Duesbery, Alonzo, & Tindal, 2005).

Inference-making and Reading Comprehension. The complex ability to make inferences “requires that readers consider multiple elements of text simultaneously and relate those text elements to prior knowledge” and “consider simultaneously multiple mental representations” (Cartwright, 2009, p. 126). Readers who are unable to integrate information across texts with prior experiences or background knowledge demonstrate lower reading comprehension (Cain & Oakhill, 1999; Oakhill, Cain, & Bryant, 2003; Oakhill, Yuill, & Parkin, 1986). Cromley and Azevedo (2007) reported a statistically significant direct relationship between inference-making and reading comprehension (.192). In a four-year longitudinal study of seven- and eight-year olds, a path analysis by

Oakhill and Cain (2012) reported the ability to make inferences was predictive of reading comprehension four years later.

Motivation and Reading Comprehension. Although conventional wisdom suggests that motivation has a direct effect on comprehension, to date, researchers have been unable to support this hypothesis empirically (Baker & Wigfield, 1999; Guthrie, Wigfield, Metsala, & Cox, 1999). Despite the lack of empirical evidence, educational stakeholders still recommend that teachers focus on reading motivation. For example, the fourth recommendation of the IES Practice Guide to Improving Adolescent Literacy (Kamil et al., 2008) is to increase student motivation and engagement in literacy learning. This study attempted to provide additional support to the limited literature base by examining the direct relationship of motivation and reading comprehension of seventh and eighth graders as part of a multi-component model.

Vocabulary and Inference-making. If students do not understand the meaning of a word they encounter in text, it is logical that they are unlikely to make inferences or causal connections. A small literature base exists on this relationship (Kameenui et al., 1982; Medo & Ryder, 1993; Stahl, Jacobson, Davis, & Davis, 1989). However, Cromley and Azevedo (2007) reported a direct effect (.207) of vocabulary on inference-making.

Vocabulary and Sentence Fluency. Few would disagree with the premise that a reader must be able to accurately decode a word to understand its meaning from written text. Indeed, Cromley and Azevedo's (2007) path analysis calculated a correlation of .603 between word reading and vocabulary. Similarly, Singer and Crouse (1981) noted a statistically significant loading of .40 for decoding on vocabulary for middle school students. This study proposed a correlation of vocabulary with fluency similar to that of the DIME model by assessing students' sentence-level fluency and comprehension using the TOSREC (Wagner et al., 2010). According to a validation study by Johnson and colleagues (2011), the TOSREC and ORF may be used interchangeably with no additional benefits.

Vocabulary and Background Knowledge. A strong direct relationship between vocabulary and background knowledge (.714) was reported in the DIME Model. Cromley and Azevedo's findings (2007) are congruent with Stanovich and colleagues' research, which noted a correlation between vocabulary and background knowledge for fourth-, fifth-, and sixth-grade students (Cunningham & Stanovich, 1991), eleventh-grade students (Cunningham & Stanovich, 1997), and undergraduate students (Stanovich, West, & Harrison, 1995).

Background Knowledge and Sentence Fluency. Cromley and Azevedo (2007) hypothesized and reported a quantitative correlation between background knowledge and word reading fluency (.541), based on Cunningham and Stanovich's (1991) study, which reported a statistically significant correlation (.55) between background knowledge and word reading for 134 students grades four through six. This study proposed a similar correlation between background knowledge and sentence fluency utilizing the comparable TOSREC measure (Denton et al., 2011; Johnson et al., 2011).

Motivation, Vocabulary, and Reading Comprehension. Although not directly measured or reported widely, one could infer the important connections among motivation, vocabulary, and reading comprehension through deductive reasoning. That is, motivation leads to an increased amount of reading; students who are motivated read three times as much as less motivated students (Guthrie & Wigfield, 1997). The majority of vocabulary is not acquired through direct instruction but in context, through wide and varied reading (Anderson & Armbruster, 1984; Nagy & Anderson, 1984; Nagy, Anderson, & Herman, 1987; Nagy, Herman, & Anderson, 1985; Read, 1986; Read & Hodges, 1982; Rice, Meyer, & Miller, 1988; Stanovich, 1986). Motivated readers are engaged in more text, leading to the incidental learning of new words that positively influences reading comprehension.

Motivation, Inference-making, and Reading Comprehension. The ability to make inferences, or read between the lines, is central to reading comprehension (Singer, 1994; Van den Broek, 1994). Struggling readers have consistently shown an inability or lower ability to infer meaning from text (e.g., Cain & Oakhill, 1999; Oakhill, 1982, 1984). A higher-level cognitive skill, inferential processing is required across all content areas and is one of the more difficult requirements adolescents face in reading because they must make assumptions based on textual evidence. That is, they must integrate literal information from the text with their own background knowledge to make sense of what they read.

The present study proposed an indirect relationship of inferential processing and reading comprehension mediated by motivation. Inference-making requires a higher level of cognitive processing and is a difficult skill to master. Motivation affords readers the ability to persist through difficult academic tasks (Larson, 2000; Maehr, 1984; Pintrich & Schrauben, 1992; Pintrich & Schunk, 1996; Wigfield, 1994; Wolters &

Rosenthal, 2000). This study empirically tested whether motivated students were more likely to persist in difficult academic tasks, specifically inference-making, and to perform better in reading comprehension.

Motivation and Background Knowledge. According to an extensive review of literature on prior knowledge (Dochy & Alexander, 1995), background knowledge has been found to be a multidimensional construct that includes different levels and categories of knowledge and has numerous but congruous definitions. Background knowledge, or the relationship of the reader's skills and personal experiences to reading comprehension (Neisser, 1976) has been well documented (e.g., R. C. Anderson, 1977; R. C. Anderson & Pearson, 1984; RAND Reading Study Group, 2002; Rumelhart, 1981); however, to our knowledge, the relationship between background knowledge and experiences to motivation has not been empirically tested.

This study proposed a correlational relationship between background knowledge and motivation based on Neisser's (1976) definition. Readers bring varying levels of skills and experiences to the text. Students' academic experiences of success and failure are directly associated with their self-efficacy as readers (Harter et al., 1992; Wigfield, 1994).

Proposed Paths

This study tested two variations of the Modified DIME model (see Figures 3 and 4) as well as two Multicomponent Models of Reading Comprehension that were variations of the DIME model (see Figures 5 and 6). The Multicomponent Model of Reading Comprehension proposes twelve direct and indirect relationships among background knowledge, vocabulary, inference-making, sentence fluency, motivation, and reading comprehension. The four models tested in this study included:

1. Modified DIME Model 2: Sentence Fluency with Vocabulary (see Figure 3)
2. Modified DIME Model 3: Sentence Fluency on Vocabulary (see Figure 4)
3. Multicomponent Model 1 of Reading Comprehension: Vocabulary and Inference on Motivation (see Figure 5)
4. Multicomponent Model 2 of Reading Comprehension: Motivation on Vocabulary and Inference; addition of Motivation with Sentence Fluency (see Figure 6)

Figure 3. Modified DIME Model 2.

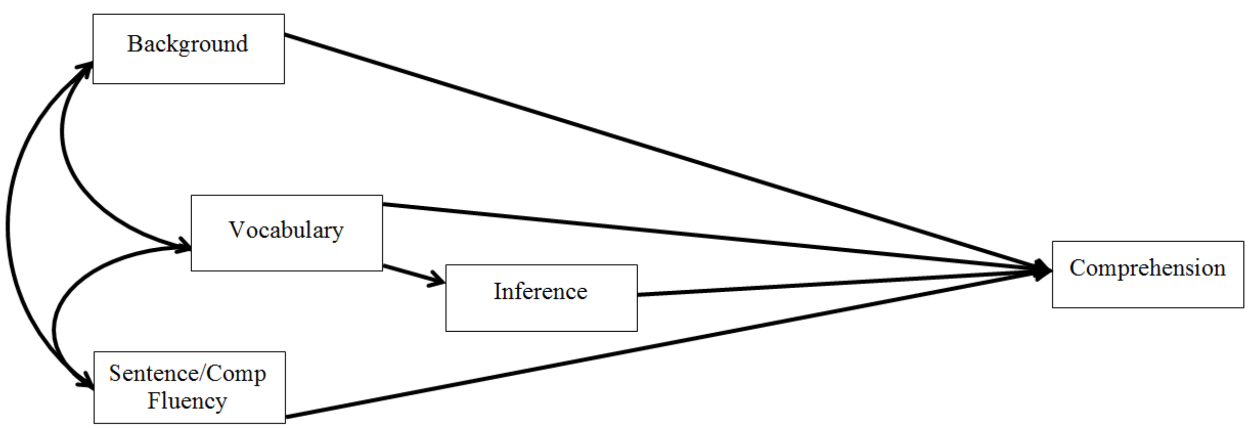


Figure 4. Modified DIME Model 3.

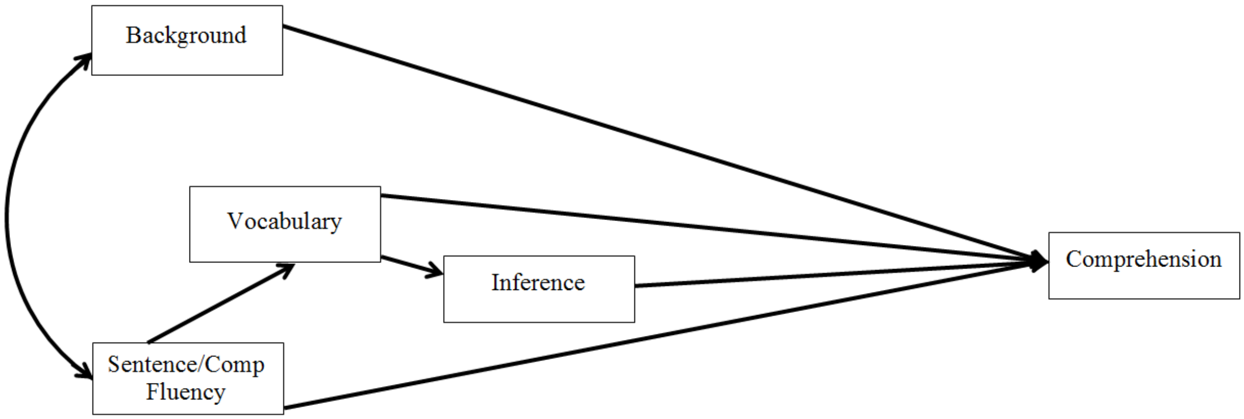


Figure 5. Multicomponent Model 1 of Reading Comprehension.

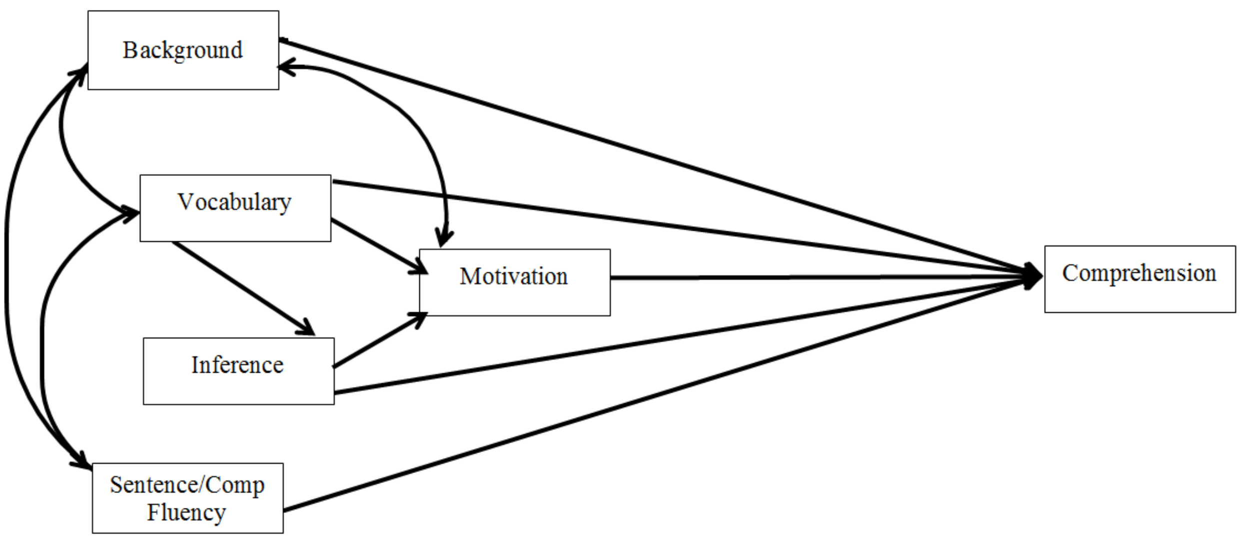
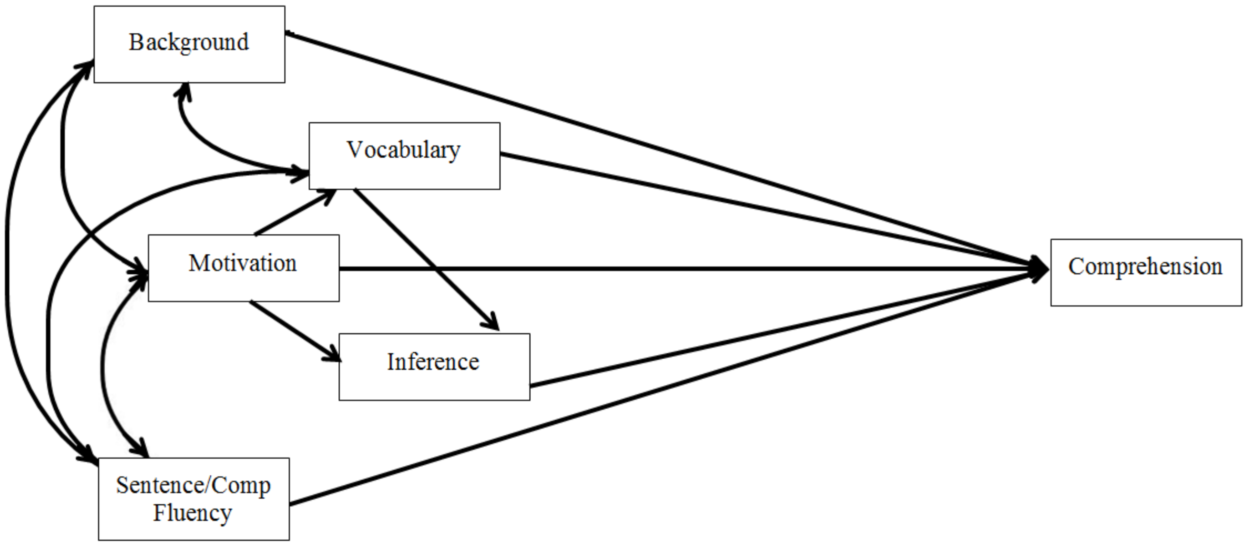


Figure 6. Multicomponent Model 2 of Reading Comprehension.



CHAPTER III

METHODS

Research Design and Context

This study tested a priori models based on prevailing theory and literature and employed correlational analyses to examine the direct and indirect relations among multiple components. Components examined include motivation, vocabulary, sentence comprehension fluency, background knowledge, strategy use, and inference-making.

Data were from a larger intervention study of reading comprehension and were collected in September of the academic year prior to intervention. The study was conducted in a junior high school in Central Texas that serves 319 seventh- and eighth-grade students. The school demographics consist of 28.3% African American, 29.7% Hispanic, 37.4% White, 1.1% American Indian, and 3.4% Two or More Races. In addition, 73% of students were labeled economically disadvantaged, 49.9% were considered at risk, and 11.9% had special education placement.

Participants

The participants included 172 seventh- and eighth-grade students from 12 English Language Arts classes of three teachers who assented to participate. One general rule for the Structural Equation Modeling (SEM) assumption of adequate sample size is for the sample size to meet at least 15 cases per predictor variable (Stevens, 1996). This sample exceeded this general guideline with 172 cases and six predictors. Participants were 11-15 years old (M = 13.06, SD = .694) and were racially diverse (33% White, 42% Black, and 25% Hispanic). Of the 172 participants, 140 (81%) qualified for free and reduced lunch, and eight (4%) students received special education services. These demographics were representative of the school as a whole.

Struggling readers were identified as students scoring at or below the 25^{th} percentile using the normative percentile ranks on the Gates-MacGinitie reading comprehension subtest according to the fall administration in the scoring manual (MacGinitie et al., 2007). Based on normative data, seventh-grade students who had a raw score of 20 or less and eighth graders who scored at or below a raw score of 23 were considered to have scored in the bottom 25^{th} percentile. A total of 77 struggling readers were identified from the total sample. Struggling readers scored a mean of 15.24 and standard deviation of 5.04 on the Gates-MacGinitie reading comprehension subtest.

Materials and Measures

Written student assent and parental permission were required and obtained from all participants. Consent and assent forms may be found in the Appendix. Student demographic information provided by district personnel included age, race or ethnicity, gender, and special education status. Measures indicated with an asterisk are based on those used in Cromley and Azevedo's DIME Model (2007).

Reading Comprehension.* The Gates-MacGinitie comprehension subtest (Level 7/9, Form S; MacGinitie et al., 2001) was administered to students. Comprised of 14 short passages and 48 multiple-choice questions, it is a nationally normed, paper-and-pencil test with questions from both narrative and informational texts, and questions that were both literal and inferential. The observed reliability was .91. The maximum raw score is 48.

Vocabulary.*Students' general reading vocabulary was assessed using the vocabulary subtest (Level 7/9, Form S) from the Gates-MacGinitie Reading Test ([GMRT]; MacGinitie, MacGinitie, Maria, & Dreyer, 2001). The fourth edition of the GMRT is a nationally normed, 45-item, multiple-choice, paper-and-pencil test with a reported test-retest reliability score of .90 (MacGinitie, MacGinitie, Maria, & Dreyer, 2002). The maximum possible score is 45. The measure was used in the DIME model and the current study. However, unlike the Cromley and Azevedo (2007) study, which used 23 multiple-choice items from the measure, the entire measure of 45 items was administered in the current study. The observed reliability for the sample was Cronbach's $\alpha = .83$.

Sentence Comprehension Fluency. Unlike the DIME Model, which used a three-part word fluency composite of speed and accuracy fluency measures (letter-word identification and word attack subtest of the Woodcock Diagnostic Reading Battery (Woodcock, 1997) and a one-minute timed reading measure of accuracy), this study administered the TOSREC; (Wagner et al., 2010). A sentence verification assessment, the TOSREC is a 3-minute timed measure that requires students to read statements and evaluate the truthfulness of each sentence. It combines accuracy with speed to measure reading fluency and has been found to be a reliable measure strongly related to reading comprehension (Denton et al., 2011).

The TOSREC "requires a fluent recognition of printed words, ability to process grade-level appropriate sentence structure, knowledge of grade-level-appropriate vocabulary, adequate working memory capacity to process realistic sentences, the ability to make appropriate inferences, and possession of relevant background knowledge" (Pro-Ed, 2012, para. 1). Form A was administered for both Levels 7 and 8.

Background Knowledge. To assess background knowledge, the study utilized the GMRT, a measure based on the Gates-MacGinitie reading passages (Barnes & Watkins, 2010), which required students to answer questions based on the version of the Gates-MacGinitie passages they read. The GMRT also assessed the reader's knowledge of vocabulary pertinent to the Gates passages as well as related background knowledge by generating both a word and a world knowledge score. The measure consisted of 29 multiple-choice questions with three answer choices. The maximum possible score is 29. Reliability was calculated for this sample with a Cronbach's α of .571 (M = 18, SD = 4.98).

Inference-making. Researchers modified the DIME model by including a researcher-developed 24-item, multiple-choice assessment to measure students' reading comprehension, including their ability to make inferences based on two passages from the Adolescent Literacy Inventory ([ALI]; Brozo & Afflerbach, 2010). These passages were a narrative passage, "Barrio Boy" by Ernesto Galarza and an expository text, "A Portrait of Americans." Lexile levels were calculated and guided the selection of these two passages that fell within grades 7 and 8 (880L to 1,010L; Stenner, Koons, & Swartz, 2009). The narrative passage was assigned a Lexile of 930L and the informational text a Lexile of 1,000L.

From the two passages, 31 questions were modified from the ALI to measure reading comprehension. Twenty-four questions were identified as inferential questions.

The 24 questions were categorized into the following six types of inferences (a) character, topic or people, (b) key facts, (c) setting or context, (d) vocabulary, (e) plot, and (f) main idea or lesson learned (see Table 3). According to basic descriptive on the inference questions, seventh- and eighth-grade students performed better on the narrative passage (74.03% and 75.40%, respectively) than the expository text (54.41% and 50.98%, respectively). Students read both passages and answered all 31 questions with four multiple-choice options. Of the 31 questions, 24 were analyzed in this study as the inference measure. One point was awarded for each correct answer, with a maximum possible score of 24 for the inference measure. Reliability was calculated for this sample with a Cronbach's α of .71 (*M* = 19.72, *SD* = 5.39).

Table 3. Inference Measure Based on "Barrio Boy" and "A Portrait of Americans"

Question Category	Total Number of Questions (n)	Question Number from Measure
Character/Topic/People	6	1, 11, 13, 16, 20, 29
Key Fact	3	21, 27, 28
Setting/Context	3	2, 17, 26
Vocabulary	3	3, 5, 22
Plot	5	4, 6, 9, 12, 15
Main Idea/Lesson Learned	4	14, 24, 30, 31

Motivation. This study purposefully selected items from a measure of motivation that best represented the construct of motivation. Thirteen of the Motivation to Read Survey's (MRS; Wolters, Denton, York, & Francis) 54 questions were selected and administered, grouped by social motivation (*n* = 3), intrinsic motivation (*n* = 4), extrinsic motivation (*n* = 3), and self-efficacy (*n* = 3). The measure posed personal questions and asked students to answer on a 5-point Likert scale ranging from "Not at all true of me" to "Very much true of me." A sample question for intrinsic motivation read, "It doesn't matter to my friends whether I'm a good reader or not." Participants were asked to use the 5-point Likert scale to rate their personal beliefs of the amount of truth of the statement. The subset of items has yet to be validated for reliability, so an internal consistency test of reliability will be conducted and Cronbach's α will be reported. Reliability was calculated for this sample with a Cronbach's α of 0.79 (*M* = 37.1, *SD* = 8.04).

Procedure

In their regular classrooms, the students completed the following group-administered measures over two school days. One class period was unable to complete the TOSREC measure because of time constraints. Researchers attended a one-day training on standardized procedures, confidentiality, data handling, and reliability. Researchers used standardized administration instructions, and students were asked to answer the questions to the best of their ability. Neither assistance nor answers were provided to the participants. To ensure the security and integrity of the data, researchers remained in the classroom for the administration of all measures with the exception of the demographic information that was collected by the teacher on a later day.

CHAPTER IV

ANALYSES AND RESULTS

Descriptive Analyses

Descriptive analyses of the five components of reading comprehension (vocabulary, motivation, inference-making, sentence comprehension fluency, and background knowledge) and comprehension for the full student sample as well as the subset of struggling readers are reported in Table 4.

Table 4. Descriptive Analyses of Measures of Raw Scores

	Entire Sample (n = 172)					***Range***
Measure	*M*	*SD*	*Skew.*	*Kurt.*	*Min/Max*	
Comprehension	29.37	3.41	0.08	-1.17	24-35	0-48
Vocabulary	18.69	6.94	0.33	-0.14	3-39	0-45
Motivation	3.21	0.48	0.04	-0.44	2.0-4.33	1-5
Inference	19.72	5.39	-0.05	0.03	3-30	0-24
Sentence	23.74	6.55	0.05	-0.45	9-38	0-Timed
Background	18.00	4.97	-1.74	3.97	0-27	0-29

Table 4. Continued

	Struggling Readers (n = 77)					***Range***
Measure	*M*	*SD*	*Skew.*	*Kurt.*	*Min/Max*	
Comprehension	15.24	5.04	-0.38	0.10	0-23	0-48
Vocabulary	14.90	5.20	0.23	-0.35	3-28	0-45
Motivation	3.15	0.51	0.34	-0.34	2.25-4.33	1-5
Inference	16.89	5.05	-0.42	-0.19	3-27	0-24
Sentence	22.02	5.46	-0.51	0.07	9-32	0-Timed
Background	16.12	5.39	-1.27	1.85	0-23	0-29

Note: All reported scores are raw scores. Sentence = sentence comprehension fluency; Background = background knowledge; M = mean; SD = standard deviation; Skew = skewness; Kurt = kurtosis; Min/Max = minimum and maximum scores reported for sample; Range = range of possible scores for the entire measure.

Data Analyses

Simple bivariate correlations were calculated using SPSS. All components were significantly correlated at the .05 or .001 level with the reading comprehension measure excepting sentence comprehension fluency (see Table 5). The inference measure correlated significantly with all measures. With the exception of motivation and sentence comprehension fluency, all measures were significantly correlated with vocabulary.

Table 5. Model Component Correlations (n = 172)

	Variable	Correlation Coefficient 1	2	3	4	5	6
1.	Comprehension	1.00					
2.	Inference	.669**	1.00				
3.	Background	.327**	.214**	1.00			
4.	Motivation	.168*	.186*	.130	1.00		
5.	Sentence	.131	.172*	.069	.100	1.00	
6.	Vocabulary	.701**	.570**	.319**	.087	.071	1.00

** Correlation is significant at the .05 level.*
*** Correlation is significant at the 0.01 level.*
Note: Sentence = sentence comprehension fluency; Background = background knowledge.

Structural Equation Modeling. Structural equation modeling (SEM) was used to simultaneously examine the direct and indirect relations between components and reading comprehension outlined in both variations of the Modified DIME Models 2 and 3 and Multicomponent Models 1 and 2 of Reading Comprehension. Path analysis was used to measure the empirical estimation of the strength of the hypothesized relations among reading components tested using the statistical software MPlus Version 6.12 (Muthén & Muthén, 1998-2010). First, the hypothesized models were estimated using maximum likelihood and tested for goodness of fit. To determine the model fit, the following indices were calculated: chi square (χ^2), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), and r-squared (R^2).

Research Question 1

Which Variation of the Modified DIME Models of Reading Comprehension had the Best Fit for the Full Sample of Seventh- and Eighth-grade Participants?

This study tested best model fit of the modified DIME Models 2 and 3 by Cromley and

Azevedo (2007). The modifications included eliminating the reading strategy measure and two substitutions (sentence fluency replaced word reading and a comparable measure of inference was substituted for that in the original model). Cromley and Azevedo tested four variations of the DIME model; however, the data from this study were only applicable to two of the four variations (Models 2 and 3) because the other two variations were dependent on the strategy measure not administered in the present study.

Cromley and Azevedo's Model 2 tested the direct and indirect relationships among components of reading comprehension. In addition to eliminating the strategy measure, the modified Model 2 study substituted fluency and inference measures. All five of the direct path coefficients were statistically significant as well as the correlation between vocabulary and background knowledge.

Cromley and Azevedo's Model 3 varied from Model 2 in that it tested a direct path from fluency to vocabulary rather than a correlation. The path was not found to be statistically significant, but the inclusion of the direct path changed the statistical relationship between background knowledge and vocabulary.

When tested for best fit, Modified DIME Model 2 of Reading Comprehension had a χ^2 value of 3.369 with 2 degrees of freedom, and a *p* value of .185 (see Table 6). Chi square is considered a "badness of fit" index where a higher value indicates a poorer fit of the model with the data. The chi-square value for DIME Model 2 is low and is not statistically significant, which indicates a favorable fit. DIME Model 2 also had RMSEA of .063, which is considered a reasonable amount of error. Values below .05 are considered good fit with minimal error; values between .05 and .08 are considered a fair fit with a reasonable amount of error, and those equal or above .08 indicate poor fit and an unreasonable amount of error (Browne & Cudeck, 1993). Additionally, this model had a CFI of .993, which is considered a favorable fit. Models with CFI values over .90 indicate reasonably good fit (Hu & Bentler, 1999). The SRMR was .029 which is considered a favorable fit because values below .10 are considered acceptable. The amount of variance for reading comprehension explained by the model was 63.1%; however, the R^2 considers the model as a whole even if parts of the model have poor fit. Table 7 contains the standardized path coefficients, *p* values, and the statistical significance for all eight paths of the Modified DIME Model 2 of Reading Comprehension. These are also displayed in Figure 7.

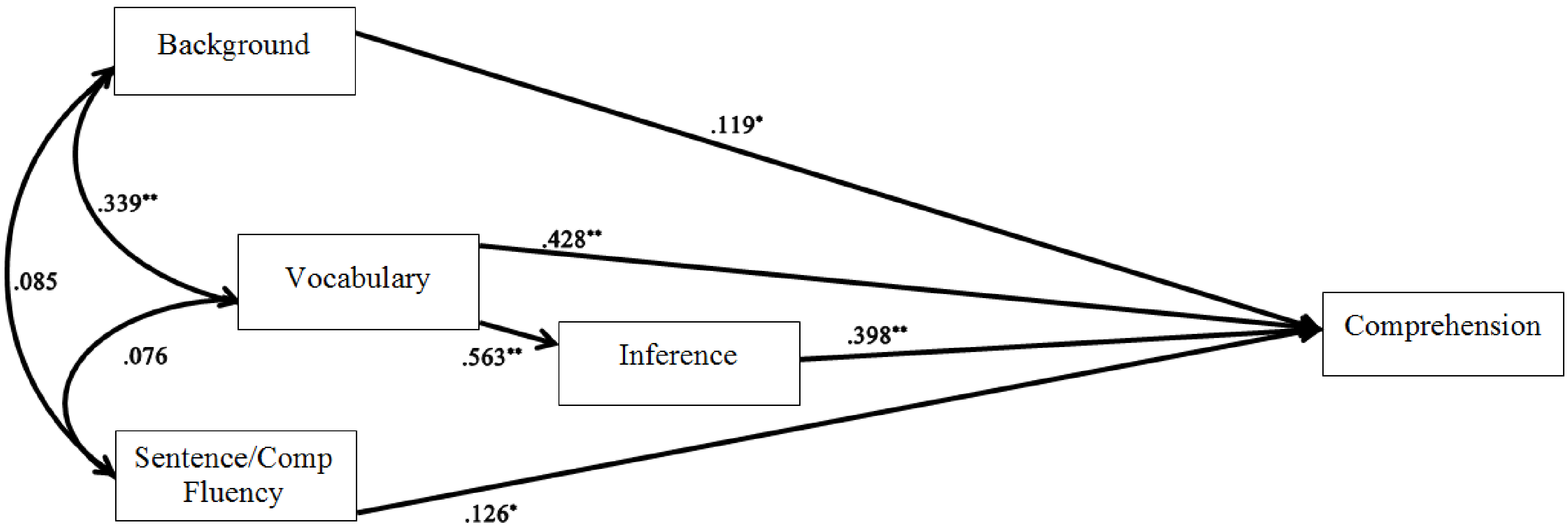
Modified DIME Model 3 of Reading Comprehension had a higher and less favorable $\chi^2$of 17.657 with 3 degrees of freedom, and a *p* value of less than .001, indicating poor fit. DIME Model 3 had an RMSEA of .169, which is an unacceptable level of error, also indicating poor fit (Stage, Carter, & Nora, 2004). DIME Model 3 had a CFI of .935, which is considered a good fit. The SRMR was .110, which was higher than Model 2, but was considered an unfavorable fit because it was over the benchmark of .10. The amount of variance explained by Model 2 was 60.6%. The standardized path coefficients, *p* values, and the statistical significance for all seven paths of the Modified DIME Model 3 of Reading Comprehension are displayed in Table 8 as well as in Figure 8.

Based on the multiple fit indices calculated and reported, the path model with best fit was Modified DIME Model 2 of Reading Comprehension, hereafter referred to as the Modified DIME Model of Reading Comprehension. This reading comprehension model adequately fits the measures, variables, and observed data collected on the 172 seventh- and eighth-grade students.

Table 6. Fit Indices for Modified DIME Models

	Modified DIME Model 2	**Modified DIME Model 3**
χ^2 (df)	3.369 (2)	17.657 (3)
p value	.1855	.0005
RMSEA	.063	.169
CFI	.993	.935
SRMR	.029	.110
R^2	.631	.606

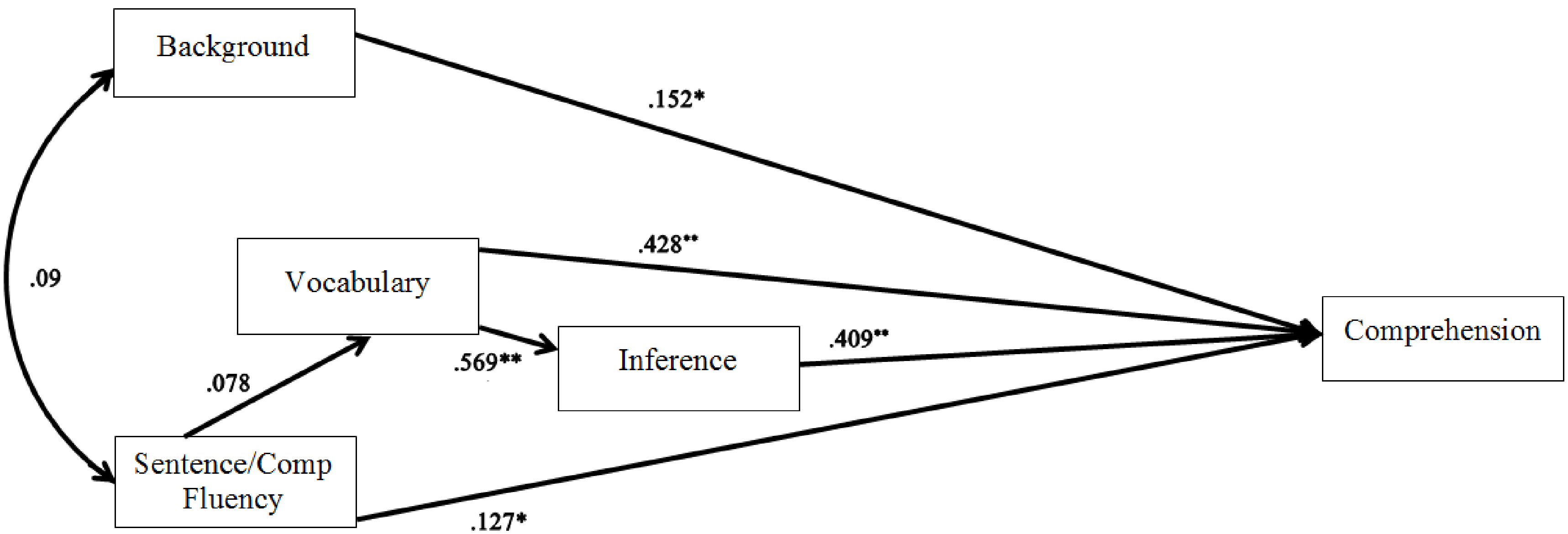
Figure 7. Modified DIME Model 2 with Path Coefficients.



** Statistical significance at the .05 level*

*** Statistical significance at the .001 level*

Figure 8. Modified DIME Model 3 with Path Coefficients.



** Statistical significance at the .05 level*
*** Statistical significance at the .001 level*

Table 7. Modified DIME Model 2 Path Coefficients

Path	Path description	Co-efficient	*p*
1	The direct effect of background knowledge on reading comprehension	.119	.038
2	The direct effect of sentence fluency on reading comprehension	.126	.013
3	The direct effect of vocabulary on inference-making	.563	< .0001
4	The direct effect of vocabulary on reading comprehension	.428	< .0001
5	The direct effect of inference-making on reading comprehension	.398	< .0001
6	The correlation of vocabulary and sentence fluency	.076	.353
7	The correlation of vocabulary and background knowledge	.339	< .0001
8	The correlation of background knowledge and sentence fluency	.085	.334

Table 8. Modified DIME Model 3 Path Coefficients

Path	Path description	Co-efficient	*p*
1	The direct effect of background knowledge on reading comprehension	.152	.010
2	The direct effect of sentence fluency on reading comprehension	.127	.015
3	The direct effect of vocabulary on inference-making	.569	< .0001
4	The direct effect of vocabulary on reading comprehension	.428	< .0001
5	The direct effect of inference-making on reading comprehension	.409	< .0001
6	The direct effect of sentence fluency on vocabulary	.078	.332
7	The correlation of background knowledge and sentence fluency	.090	.309

Cumulative effects for the Modified DIME Model of Reading Comprehension were then calculated (see Table 9). All four direct paths to reading comprehension were statistically significant. The strongest direct influences on reading comprehension are attributed to vocabulary (.428) and inference-making (.398). After calculating indirect effects, the cumulative effect of vocabulary (.654) was demonstrated to have the strongest direct and indirect relationship with reading comprehension.

Table 9. Cumulative Effects for the Modified DIME Model

Variable	Direct	Indirect	Total
Background Knowledge	.119*	-	.119*
Vocabulary	.428**	.226**	.654**
Inference	.398**	-	.398**
Sentence Fluency	.126*	-	.126*

Research Question 2

Which Variation of the Multicomponent Model of Reading Comprehension had the Best Fit? Two variations of the Multicomponent Model of Reading were tested for best fit according to a priori models based on theoretical evidence. Multicomponent Model 1 of Reading Comprehension had a χ^2 of 4.105 with 3 degrees of freedom, and a *p* value of .250 (see Table 10). The χ^2 for Model 1 was considerably low and is not statistically significant, which is favorable. Model 1 also had RMSEA of .046, which is considered a close approximate fit. Additionally, this model had a CFI of .995, further indicating a good fit. The SRMR was .031, which is considered a favorable fit because values below .10 are considered acceptable. The amount of variance explained by the model was 63.5%; however, the R^2 considers the model as a whole, even if parts of the model have poor fit. Table 11 and Figure 9 contain the standardized path coefficients, *p* values, and the statistical significance for all twelve paths of the Multicomponent Model 1 of Reading Comprehension. These are also displayed in Figure 9.

Multicomponent Model 2 of Reading Comprehension had a lower and more favorable χ^2 of 2.80 with 2 degrees of freedom, and a *p* value of .246 (see Table 10). Model 2 had an RMSEA of .048, which is also an acceptable level of error (Stage et al., 2004). It also had a CFI of .996, which is considered a good fit. The SRMR was .022 which was lower than Model 1, and still considered a favorable fit. The amount of variance explained by Model 2 was 63.5%. The standardized path coefficients, *p* values, and the statistical significance for all twelve paths of the Multicomponent Model 2 of Reading Comprehension are displayed in Table 12 as well as in Figure 10.

Based on the multiple fit indices calculated and reported, the path model with best fit was Multicomponent Model 2 of Reading Comprehension, hereafter referred to as the Multicomponent Model of Reading Comprehension or MMRC. This reading comprehension model adequately fits the measures, variables, and observed data collected on the 172 seventh- and eighth-grade students.

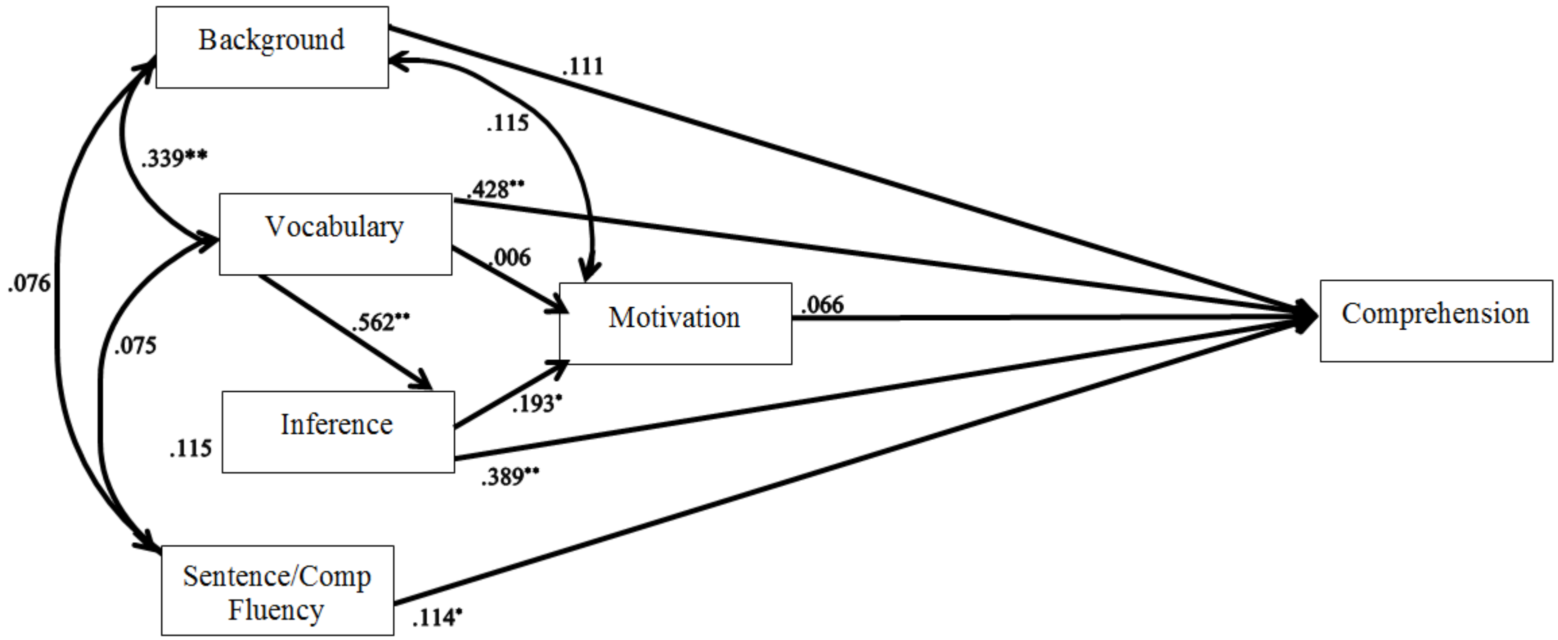
Table 10. Fit Indices for Multicomponent Models of Reading Comprehension

	MMRC Model 1	MMRC Model 2
χ^2 (df)	4.105 (3)	2.80 (2)
p value	.250	.246
RMSEA	.046	.048
CFI	.995	.996
SRMR	.031	.022
R^2	.635	.635

Table 11. Multicomponent Model 1 of Reading Comprehension Path Coefficients

Path	Path description	Co-efficient	*p*
1	The direct effect of background knowledge on reading comprehension	.111	.053
2	The direct effect of sentence fluency on reading comprehension	.122	.016
3	The direct effect of vocabulary on inference-making	.562	< .0001
4	The direct effect of vocabulary on reading comprehension	.428	< .0001
5	The direct effect of inference-making on reading comprehension	.389	< .0001
6	The correlation of vocabulary and sentence fluency	.075	.354
7	The correlation of vocabulary and background knowledge	.339	< .0001
8	The correlation of background knowledge and sentence fluency	.076	.392
9	The direct effect of motivation on reading comprehension	.066	.197
10	The indirect effect of vocabulary on reading comprehension through motivation	0.002	–
11	The indirect effect of inference-making on reading comprehension through motivation	.075	–
12	The correlation of background knowledge and motivation	.115	.296

Figure 9. Multicomponent Model 1 of Reading Comprehension with Path Coefficients.

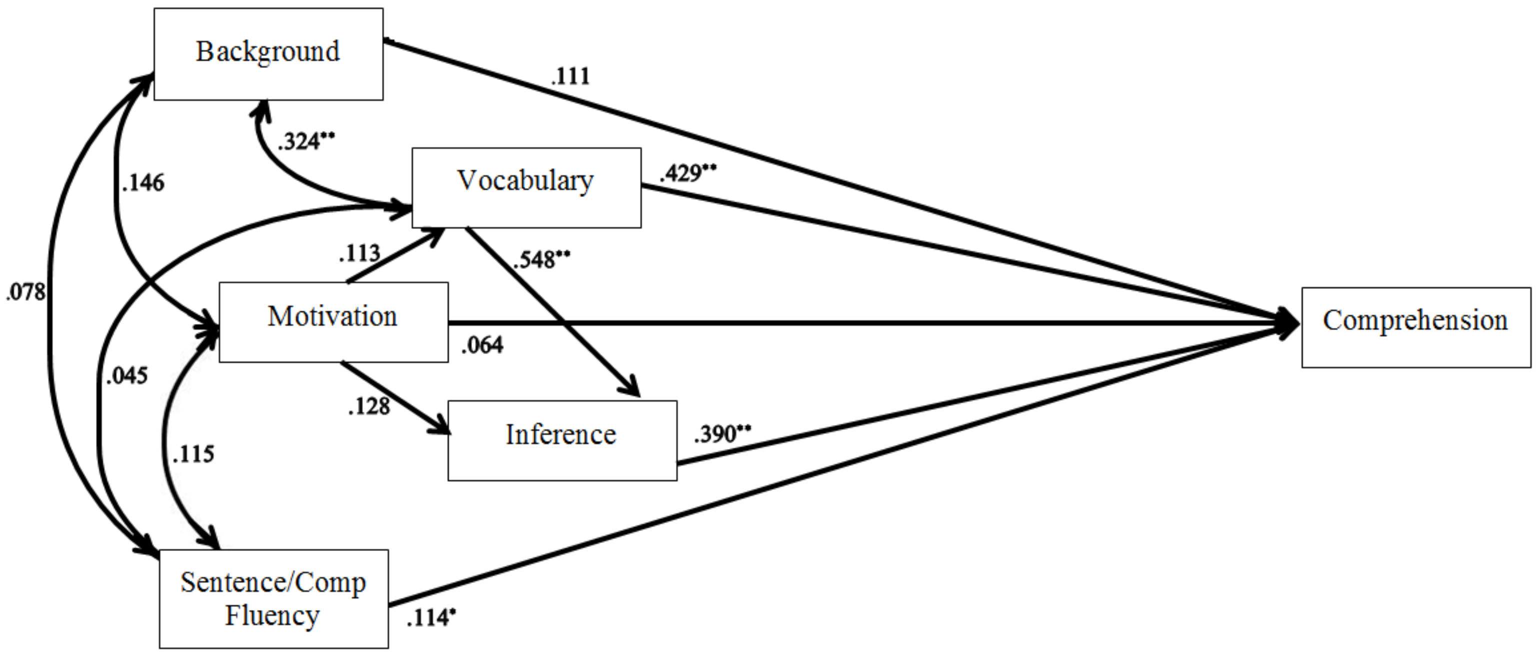


** Statistical significance at the .05 level*
*** Statistical significance at the .001 level*

Table 12. Multicomponent Model 2 of Reading Comprehension Path Coefficients

Path	Path description	Co-efficient	*p*
1	The direct effect of background knowledge on reading comprehension	.111	.053
2	The direct effect of sentence fluency on reading comprehension	.114*	.023
3	The direct effect of vocabulary on inference-making	.548	< .0001
4	The direct effect of vocabulary on reading comprehension	.429**	< .0001
5	The direct effect of inference-making on reading comprehension	.390**	< .0001
6	The correlation of vocabulary and sentence fluency	.045	.582
7	The correlation of vocabulary and background knowledge	.324	<.0001
8	The correlation of background knowledge and sentence fluency	.078	.375
9	The direct effect of motivation on reading comprehension	.064	.201
10	The indirect effect of vocabulary on reading comprehension through motivation	.048	.172
11	The indirect effect of inference-making on reading comprehension through motivation	.050	.074
12	The correlation of background knowledge and motivation	.146	.198

Figure 10. Multicomponent Model 2 of Reading Comprehension with Path Coefficients.



** Statistical significance at the .05 level*
*** Statistical significance at the .001 level*

Within the MMRC, there were six direct influences among reading components, two indirect influences, and four correlational relationships. Direct influences of reading components were reported as path coefficients (see Figure 4).

Cumulative indirect influences of variables may be calculated by hand as the product of direct effects of other components. For example, to calculate the indirect effect of motivation on reading comprehension through vocabulary, one would multiply the direct effect of motivation and vocabulary (.113) by the direct effect of vocabulary and comprehension (.429) to find the indirect effect product of .048. Hand calculation of indirect effects does not yield *p* values of statistical significance; however, indirect effects with these additional data may be calculated using MPlus.

Upon examining indirect effects of Multicomponent Model 2 of Reading Comprehension, motivation did not have a direct relationship with reading comprehension (.064, p = .210), but rather a total indirect influence (.122, p = .038). Specific indirect effects found motivation to mediate inference-making and comprehension (.050, p = .074) and mediate vocabulary and comprehension (.048, p = .172). Table 13 reports direct, cumulative indirect, and overall total effects for the MMRC.

The addition of motivation to the modified DIME Model 2 did not change any relative relationships among variables in a statistically significant way (see Table 14). Favorable fit is more difficult to achieve for models with numerous paths because there are more places where misfit can occur. The coefficients remained comparable, and components that were statisitically significant remained so for both models with the exception of background knowledge becoming marginally statistically significant (p = .053).

Table 13. Cumulative Effects for the MMRC

Variable	Direct	Indirect	Total
Background Knowledge	.111	-	.111
Vocabulary	.429**	.214**	.643**
Inference	.390**	-	.390**
Motivation	.064	.122*	.186*
Sentence Fluency	.114*	-	.114*

Table 14. Comparison of component relationships between Modified DIME and MMRC

Path	Path description	Modified DIME	*p*	MMRC	*p*
1	The direct effect of background knowledge on reading comprehension	.119	.038	.111	.053
2	The direct effect of sentence fluency on reading comprehension	.126	.013	.114	.023
3	The direct effect of vocabulary on inference-making	.563	< .0001	.548	< .0001
4	The direct effect of vocabulary on reading comprehension	.428	< .0001	.429	< .0001
5	The direct effect of inference-making on reading comprehension	.398	< .0001	.390	< .0001
6	The correlation of vocabulary and sentence fluency	.076	.353	.045	.582
7	The correlation of vocabulary and background knowledge	.339	< .0001	.324	< .0001
8	The correlation of background knowledge and sentence fluency	.085	.334	.078	.375
9	The direct effect of motivation on reading comprehension	–	–	.064	.201
10	The indirect effect of vocabulary on reading comprehension through motivation	–	–	.048	.172
11	The indirect effect of inference-making on reading comprehension through motivation	–	–	.050	.074
12	The correlation of background knowledge and motivation	–	–	.146	.198

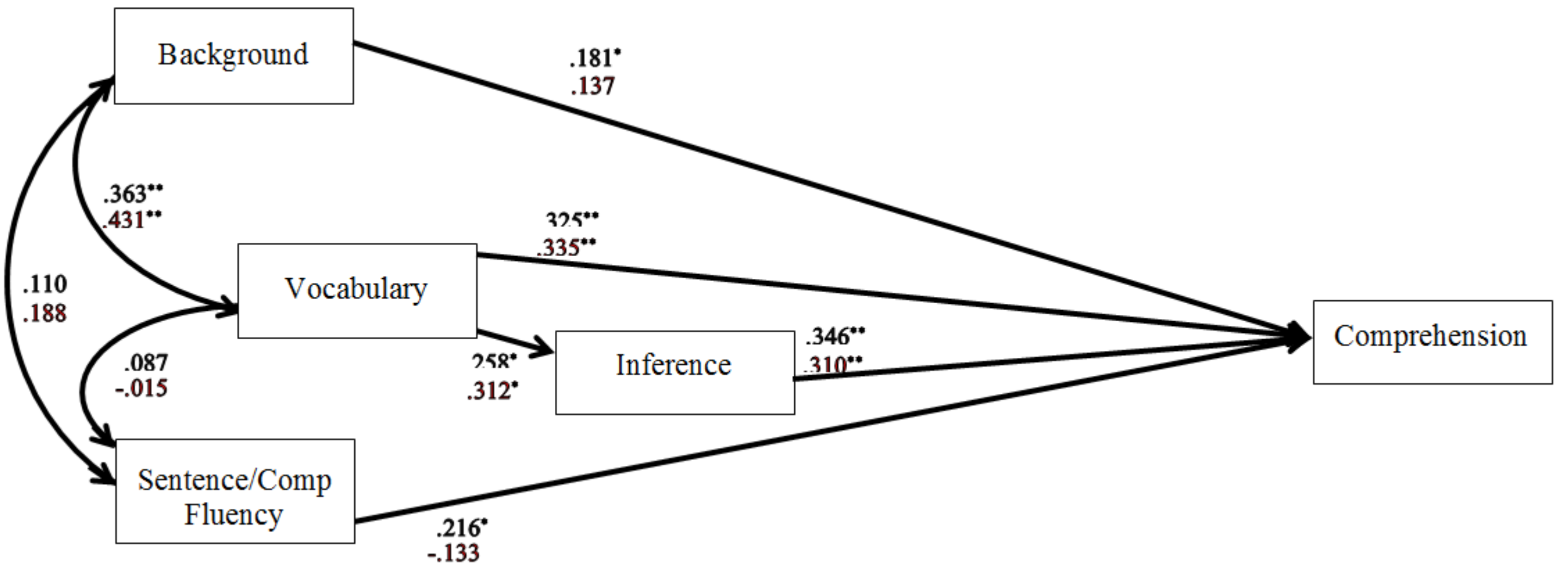
Research Question 3

Do the Interrelationships Among the Reading Comprehension Components Differ for Struggling Readers Versus Typical Readers? Modified DIME Model and MMRC showed the best fits of the four models for the full sample. To identify whether relations among variables were consistent for the 95 typical readers (students who scored above the 25th percentile on the Gates-MacGinitie reading comprehension subtest) and the 77 struggling readers (students who scored below the 25th percentile) models were run separately.

Two interrelationships varied between typical and struggling readers on the Modified DIME Model (see Figure 11). The relationship between background knowledge and comprehension was statistically significant for typical readers as well as the relationship between sentence fluency and comprehension. These paths were not statistically significant for struggling readers.

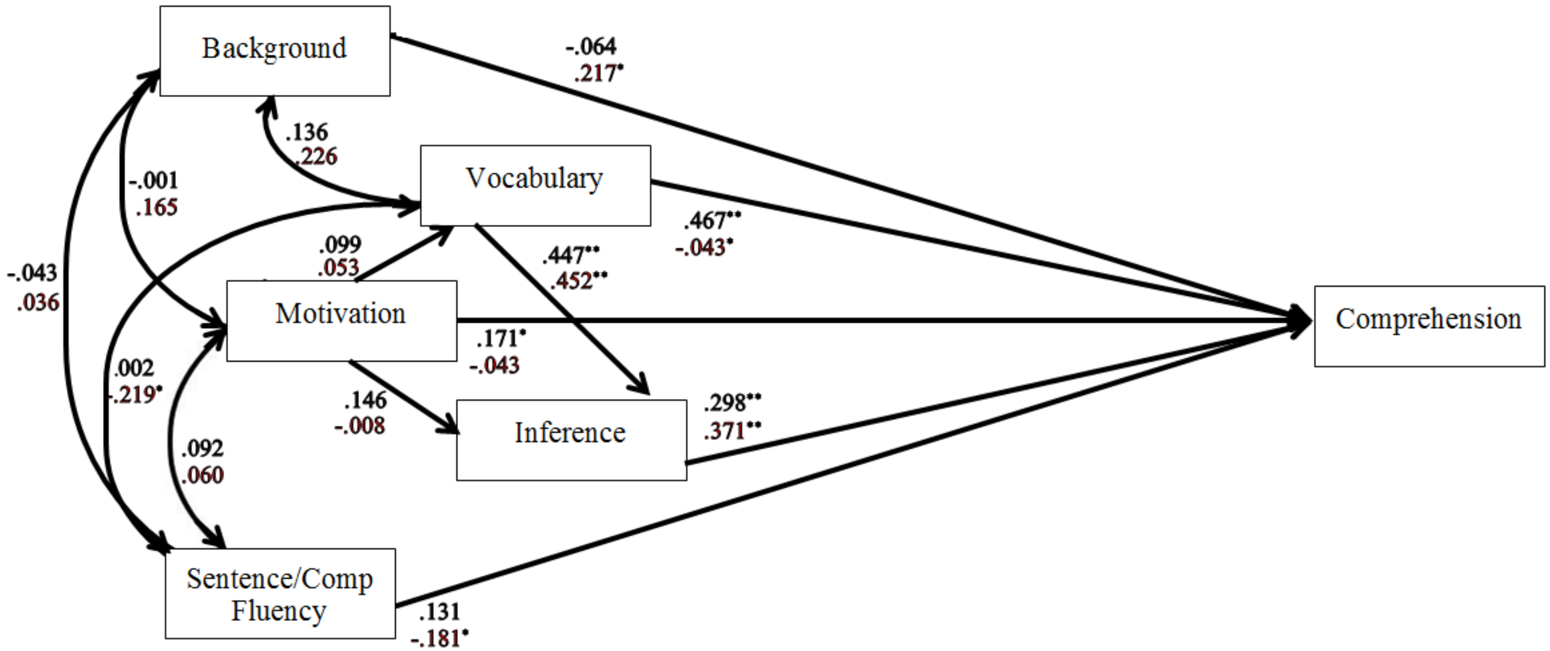
Three direct paths to reading comprehension varied between typical and struggling readers on the MMRC (see Figure 12). The relationships of background knowledge and sentence comprehension fluency to comprehension were statistically significant for struggling readers, but not for typical readers. The direct path of motivation to comprehension was statistically significant for typical readers but not struggling readers. The correlation of sentence comprehension fluency and vocabulary was statistically significant for struggling readers, but not for typical readers.

Figure 11. Comparison of Typical and Struggling Readers for Modified DIME Model.



Coefficients for typical readers are listed above those of struggling readers.
** Statistical significance at the .05 level*
*** Statistical significance at the .001 level*

Figure 12. Comparison of Typical and Struggling Readers for MMRC.



Coefficients for typical readers are listed above those of struggling readers.
** Statistical significance at the .05 level*
*** Statistical significance at the .001 level*

CHAPTER V

DISCUSSION AND CONCLUSION

Based on theory and prior research, this study tested reading comprehension models. The two types of reading comprehension models tested in this study included two modifications of the DIME model referred to as Modified DIME and two models that included motivation as a component, the Multicomponent Model of Reading Comprehension, referred to as MMRC within this study. One model from each type was selected as best fit. The reading components (vocabulary, motivation, sentence comprehension fluency, inference-making, and background knowledge) and their paths will be discussed in greater detail below, and when appropriate, the findings from the Modified DIME Model and the MMRC will be compared. The models were further examined with respect to the interrelationships of the components for both struggling and typical readers.

Research Question 1 involved testing two models to find best fit of a modified DIME Model of Reading Comprehension. Modified DIME Model 2 had the best fit and accounted for 63.1% of overall variance in comprehension. The largest direct and indirect contributors to reading comprehension were vocabulary (.654) and inference-making (.398), followed by sentence comprehension fluency (.126), and background knowledge (.119). Similarly, Cromley and Azevedo (2007) reported vocabulary to be the largest direct and indirect contributor (.406) with the DIME Model accounting for 66% of overall variance in reading comprehension. The discrepancy of explained variance for reading comprehension between the DIME and Modified DIME might be attributed to substitution of measures and the exclusion of the strategy. Additional research is required to account for the remaining 35% in the Modified DIME Model of Reading Comprehension that might include more robust measures and the inclusion of a reading strategy use measure.

Research Question 2 inquired whether the addition of motivation as a component of reading comprehension affected the interrelationships of components by determining the model with best fit. Two models of the Multicomponent Model of Reading Comprehension were tested for best fit; Model 2 provided the best overall fit and accounted for 63.5% overall variance in reading comprehension. Although no direct relationship was found between motivation and reading comprehension, motivation was the third highest indirect contributor to reading comprehension. The addition of motivation to the modified DIME showed that the two greatest total contributors to reading comprehension were still vocabulary (.643) and inference-making (.390). These were followed by motivation (.186), sentence comprehension fluency (.114), and background knowledge (.111). The addition of motivation slightly changed the statistical significance for the direct impact of background knowledge on comprehension (.111, p = .053) by making it marginally statistically significant.

Research Question 3 examined the interrelationships of the components of reading comprehension to see if there was variation between struggling and typical readers. Within the Modified DIME Model, typical readers showed a statistically significant relationship between sentence comprehension fluency and reading comprehension (.216), as well as background knowledge and reading comprehension

(.181). These relationships were not statistically significant for struggling readers. Conversely, for the MMRC, sentence the relationship of comprehension fluency and background knowledge was statistically significant for struggling readers (-.181) as opposed to typical readers (.131). In the following, I discuss direct and indirect relations of components to reading comprehension and, when relevant, compare findings to those of Cromley and Azevedo.

Components of Reading Comprehension and their Relation to the Modified DIME and Multicomponent Model of Reading Comprehension

Vocabulary and Its Relation to Reading Comprehension and Other Components. Consistent with Cromley and Azevedo's findings, vocabulary was one of the strongest predictors of reading comprehension in both the Modified DIME Model and the MMRC. Not only did vocabulary have the largest direct effect on comprehension, but also reported statistically significant indirect effects for both models. The Modified DIME Model (.428) and the MMRC (.429) support the essential role of vocabulary to the comprehension of these seventh- and eighth-grade students. These findings held true for both struggling and typical readers in each model. Findings of this study support the literature base that there is a strong direct and indirect relationship between vocabulary and reading comprehension (Hart & Risley, 2003; Hirsch, 2003; Kameenui et al., 1982; Stahl & Fairbanks, 1986).

Although the Gates MacGinitie vocabulary subtest was administered in both Cromley and Azevedo's study and this study, vocabulary reported a stronger correlation for direct, indirect, and cumulative effects on reading comprehension. These findings may be explained by an increase in question items administered to students. Cromley and Azevedo administered only the odd-numbered items (k = 23) of the vocabulary subtest, whereas this study administered the full subtest (k = 45). The number of question items in a measure can affect the psychometric properties, most notably internal consistency. Additional items in a measure often increase the reliability coefficient. This study reported a lower observed reliability of a Cronbach's α of .83, compared Cromley and Azevedo's reliability of .90-.92 (MacGinitie et al., 2002); however, Cromley and Azevedo reported the internal consistency of the entire measure rather than the odd-numbered question items administered within their sample. It is plausible to explain the stronger correlation of vocabulary in the Modified DIME and MMRC due to the increased number of question items.

The importance of vocabulary was also evidenced through a strong and statistically significant correlation of vocabulary with background knowledge in the Modified DIME Model (.339) and the MMRC (.324). These findings further support previous research on the relationship between vocabulary and background knowledge (Cunningham & Stanovich, 1991; Stanovich et al., 1995) and also those found in Cromley and Azevedo's DIME model (.714, $p < .05$). This bidirectional relationship suggests prior knowledge and vocabulary are interrelated and influence one another.

When the models were examined for the differences between struggling readers and typical readers, the Modified DIME model reported a statistically significant interrelationship for both struggling readers (.431) and typical readers (.363); however, when motivation was added to the MMRC, the background knowledge/vocabulary relationship was not statistically significant for either struggling readers (.226) or typical readers (.136). Although the MMRC showed a strong correlation between vocabulary and background knowledge as an overall model, when the sample was broken into subgroups, no correlation was found for either group. The addition of motivation to the model changed the strength of the relation between vocabulary and background knowledge for both groups.

A direct relationship of vocabulary on inference-making, or the ability of students to make logical conclusions, was substantiated in this study. Cromley and Azevedo reported a statistically significant direct effect of vocabulary on inference-making (.207), similar to this study's Modified DIME Model (.563) and the MMRC (.548). Logically, these findings suggest that a students' knowledge of vocabulary in a text directly influences their ability to make connections between information that is implied in the text. When further examined, there were also statistically significant direct relationships between vocabulary and inference-making in the Modified DIME Model for struggling readers (.452) and typical readers (.447) as well as the in MMRC's struggling readers (.312) and typical readers (.258). In summary, the impact of vocabulary on a reader's ability to make inferences is statistically significant for both struggling and typical readers and for both the Modified DIME Model and the MMRC. The findings suggest that for all readers, inference-making requires high-level mental processing that is directly linked to the depth of word knowledge.

A statistically significant correlation was not substantiated between vocabulary and sentence comprehension fluency for either the Modified DIME Model (.076) or the

MMRC (.045). There also was no statistically significant correlation between vocabulary and sentence comprehension fluency between struggling readers (-.015) and typical readers (.087) in the Modified DIME Model, or for typical readers (.002) in the MMRC. However, findings from the MMRC indicated a significant and negative correlation (-.219) for struggling readers. This was an unexpected and challenging relation to explain; however, the relation of sentence fluency differed between models and will be elaborated on later in this section.

Inferences. The ability to make inferences had the second-highest path coefficients on reading comprehension for this study. The direct effect of inference-making on reading comprehension showed a statistically significant path for the Modified DIME Model (.398) and the MMRC (.390). Within the Modified DIME Model, typical readers (.346) and struggling readers (.310) both demonstrated a strong and statistically significant direct relationship between inference-making and reading comprehension. Typical readers indicated a slightly stronger correlation between inference-making and comprehension than struggling readers. These findings are consistent with extant research, indicating that struggling readers are able to make inferences; however, they tend to infer less than proficient readers (Cain, Oakhill, Barnes, & Bryant, 2001; Oakhill, 1982; Paris & Upton, 1976).

However, when motivation was included in the MMRC, the ability to make inferences remained statistically significant but indicated the correlation between inference-making and comprehension was stronger for struggling readers (.371) compared to typical readers (.298). These findings also substantiated the literature base by indicating struggling readers were able to make inferences; however, when motivation was included as a component of reading comprehension struggling students were more likely to make inferences than typical readers. One could reasonably conclude that typical readers make inferences as they read, but struggling readers require motivation to persist through difficult reading tasks that requiring higher level thinking, such as inference-making.

In conclusion, the ability to make inferences was directly and strongly related to reading comprehension for both the Modified DIME Model and the MMRC. The findings were also statistically significant for both typical and struggling readers in both models. Inference-making had a higher correlation for typical readers in the Modified DIME Model, but the correlation was stronger for struggling readers when motivation was considered a component in the MMRC.

Motivation. For the MMRC, motivation provided the third-highest contribution to reading comprehension; however, it is important to note that the contribution was from indirect effects. Motivation did not have a statistically significant direct effect on comprehension (.064), but rather an overall indirect effect (.122). The indirect effects measured the mediation of motivation with inference-making and vocabulary to reading comprehension. Being motivated alone did not improve reading comprehension, but motivation influenced other components of reading comprehensions such as the ability to make inferences and learn vocabulary. Although neither the mediation path of vocabulary, motivation, and comprehension nor the path of inference-making, motivation, and comprehension were statistically significant for the MMRC, the overall indirect effect was statistically significant, indicating motivation as a component of reading comprehension within the model.

The influence of motivation to reading comprehension indicated a statistically significant direct relationship between motivation and reading comprehension (.171) for typical readers, but no direct relationship for struggling readers (-.043). Congruent with conventional wisdom, the findings indicate that motivated typical readers perform higher on reading comprehension. However, no matter how motivated struggling readers were, motivation itself did not impact reading comprehension. Although motivation is a large contributor in the model, it contributes indirectly in a combined way through vocabulary and inference-making. Motivation alone is not sufficient for struggling readers; the reader must also possess fundamental skills such as decoding, vocabulary, and fluency.

Motivation as a mediator between vocabulary and comprehension was not statistically significant (.048). Similar results were reported for both typical readers (.046) and struggling readers (-.01). The path was examined under the premise that motivated readers are exposed to increased and varied vocabulary, which leads to an increased vocabulary from incidental learning (e.g., T. H. Anderson & Armbruster, 1984; Stanovich, 1986), and the more word knowledge readers have, the better they comprehend when reading. This indirect relationship was not substantiated with the given sample and set of measures.

Motivation as a mediator between inference-making and comprehension was also not statistically significant (.050). This also held true for typical readers (.043) and struggling readers (-.002).The indirect path was measured based on the theory that motivated readers are more likely to persist through the difficult task of making inferences, and readers who are better able to read between the lines have increased comprehension. Although the statistical significance was marginal, when examining subgroups, the amount of explained variance was mostly attributed to typical readers. This finding is consistent with the statistically significant relationship of motivation to reading comprehension for typical readers only. Struggling readers might be motivated, but motivation was not sufficient to predict performance on inference-making or reading comprehension measures.

Sentence Comprehension Fluency. This study hypothesized and tested the direct effect of sentence comprehension fluency on reading comprehension. Both models showed a statistically significant direct effect of sentence comprehension fluency on reading comprehension; the Modified DIME Model with a path coefficient of .126, and the MMRC with a path coefficient of .114. Prior research has documented the relation of sentence reading fluency to comprehension. In particular, Denton and colleagues (2011) determined the TOSREC to be more strongly correlated to reading comprehension for sixth-, seventh- and eighth-graders than other measures of silent reading fluency. In this study, we likewise found that students' ability to read and assess their understanding of sentences in a timed condition contributed important and unique variance. The results of a correlation between sentence comprehension fluency and reading comprehension were anticipated and confirmed in this study.

When comparing struggling readers and typical readers, the findings were divergent between models. Within the Modified DIME Model, there was a statistically significant relationship between sentence comprehension fluency and reading comprehension for typical readers (.216), but not for struggling readers (-.133). These results indicate that typical readers who performed better on a sentence comprehension fluency measure also performed better on a reading comprehension measure, but there was no significant relationship found for struggling readers. The findings suggest typical readers who read fluently have better reading comprehension, but there was no substantive support for this relationship with struggling readers. The relationship between sentence comprehension fluency and reading comprehension differs in the MMRC. The MMRC showed a statistically significant relationship between sentence comprehension fluency and comprehension for struggling readers (-.181) but not for typical readers (.131). Surprisingly, the strength of the relation was negative. The unexpected findings are inconsistent with the literature base and conventional wisdom. When motivation was added to the model, and the variance was redistributed to include a sixth variable, the negative relationship between sentence comprehension fluency and reading comprehension for struggling readers emerged for both models, but not for typical readers. The findings were also contradictory to the literature base and may be attributed to small sample size when the model was separated into typical (n = 95) and struggling readers (n =77). Additional samples are needed to determine the replicability of this finding.

A correlation of sentence comprehension fluency with background knowledge was hypothesized based on Cromley and Azevedo's correlation of word fluency and background knowledge (.541, $p < .05$). For this study, neither the Modified DIME

Model nor the MMRC showed a statistically significant correlation between sentence comprehension fluency and background knowledge. Additionally, the findings were the same among struggling and proficient readers within both models. These findings are inconsistent with Stanovich and Cunningham's (1991) study of elementary students or with Cromley and Azevedo's (2007) study of ninth-grade students; however, the fluency measures in these studies were not identical. The task given to students for this study consisted of both decoding at the sentence level and a comprehension component, rather than word identification and words read correctly per minute.

Background Knowledge. In the two reading comprehension models tested in this study, background knowledge contributed a direct and statistically significant role in reading comprehension for the Modified DIME Model (.119) and a marginally statistically significant direct effect in the MMRC (.111, p = .053). The findings of this direct relationship of background knowledge and comprehension are consistent with prior research (e.g., R. C. Anderson, 1977; Langer, 1984; Rumelhart, 1981).

Within the MMRC, the relationship between background knowledge and reading comprehension was overall marginally statistically significant (p = .053); however, the findings differed between typical and struggling readers. The findings indicated a stronger direct relationship between background knowledge and comprehension (.217) for struggling readers than typical readers (-.064). Conversely, typical readers displayed a stronger and statistically significant relationship between background knowledge and reading comprehension unlike to struggling readers in the Modified DIME Model that was statistically significant overall.

A plausible explanation for the correlation between background knowledge and motivation was measured in this study based on the concept of self-efficacy as a reader. Self-efficacy may be related to personal experiences and background knowledge. The more knowledgeable readers are about a topic, the more likely they are to view themselves as competent readers. Conversely, negative experiences or limited background knowledge may also affect a student's motivation to read the text (Harter et al., 1992; Wigfield, 1994). Contrary to prior research, this study found no statistically significant relationship between background knowledge and motivation for this sample and set of measures. This held true for both typical and struggling readers.

Limitations, Areas of Future Research, and Conclusion

Limitations of Study. There are several limitations of this study. A first limitation involves the sample size. While the sample was sufficient based on a general SEM rule that 15 participants per predictor variable was adequate (Stevens, 1996), more complex SEM models that examined differences between struggling and typical readers may require larger samples to examine the interrelationships among variables. According to Lei and Wu (2007), more complex models require larger sample sizes with a preferred minimum of 400 participants. The sample size for this study was 172 and did not meet the preferred sample size; therefore, to generalize to a larger population this study should have included more participants.

A second limitation is the technical adequacy of measures. Specifically, low reliability values of the background knowledge measure (.57) coupled with minimally acceptable reliability coefficients for motivation (.79) and inference-making (.71) was a limitation that may adversely affect generalizability. A low value of Cronbach's α for the background measure in this sample may be attributed to a small set of question items and poor interrelatedness between question items. Further research warrants a more robust and reliable background knowledge measure that might include eliminating question items that are unrelated. The motivation measure could benefit from additional question items or a motivation measure more focused on reading. The motivation measure used in this study included a range of motivation components, and a measure more focused on reading motivation may be more sensitive.

Finally, all measures were administered to students in their classrooms in one large group. There are many benefits to group-administered assessments, such as being more time- and cost-efficient as well as minimized risk of scoring error; however, there are some disadvantages to group-administered measures that make individual measures more desirable. Individual measures allow for greater in-depth observations of student behaviors, including student motivation. Student behaviors during testing may interfere with their performance on measures that go unnoticed in group-administered measures. Another benefit of individual measures, such as oral reading fluency, is that it allows the test administrator to count the number of words read correctly per minute. Oral reading fluency has consistently been highly correlated with reading comprehension (e.g., Cromley & Azevedo, 2007; L S. Fuchs et al., 2001; Wayman et al., 2007); however, this study did not measure oral reading fluency, but rather utilized the group-administered measure of sentence comprehension fluency, TOSREC (Wagner et al., 2010).

Areas of Future Research. Several implications for future study should be noted. Replication with additional students in the same grade levels and larger samples may increase the generalizability of findings. The current study used the vocabulary and comprehension subtests of Gates-MacGinitie Reading Test (MacGinitie et al., 2001). It would be interesting to substitute the Gates-MacGinitie comprehension or vocabulary measure with another standardized assessment to see if the findings are similar to this study and if the Gates-MacGinitie subtests are independent of one another. The inclusion of a strategy measure, as in the DIME model, would also be useful to examine. Future research should be conducted using the same dataset and participants to replicate the Construction Integration Model (Kintsch, 1988, 1994, 1998), Verbal Efficiency Theory (Perfetti, 1985, 1988, 1989), and DVC triangle (Perfetti, 2010).

Conclusion and Practical Implications. The purpose of this dissertation was threefold: (a) to extend our understanding of the interrelationships of reading comprehension components, (b) to examine the role of motivation and its relation to reading comprehension, and (c) to compare the relation of reading components between struggling and proficient readers.

Consistent with prior research, findings corroborated the direct influence of multiple components on reading comprehension; most notably vocabulary and the ability to make inferences. Vocabulary provided the largest direct and overall effect in both models. In the Modified DIME Model, vocabulary made the largest direct (.428) and overall contribution (.654) to reading comprehension; vocabulary also held the largest influence for the MMRC both directly (.429) and in overall influence (.653) to reading comprehension.

The large influence of vocabulary on reading comprehension suggests targeted instructional focus on vocabulary acquisition for seventh- and eighth-grade students, both typical and struggling readers. As the first recommendation for improving adolescent literacy in the IES Practice Guide, Kamil and colleagues (2008) proposed four practical recommendations to educators: (p.13-14)

- Dedicate a portion of regular classroom lessons to explicit vocabulary instruction
- Use repeated exposure to new words in multiple oral and written contexts and allow sufficient practice sessions
- Give sufficient opportunities to use new vocabulary in a variety of contexts through activities such as discussion, writing, and extended reading
- Provide students with strategies to make them independent vocabulary learners.

Similar to prior research (e.g., Cain & Oakhill, 1999; Oakhill et al., 2003; Oakhill et al., 1986), the second-largest relationship validated by this study was the direct effect of the ability to make inferences on reading comprehension. Inference-making was the second-largest direct and overall contributor for both the Modified DIME (.398) and the MMRC (.390). The findings were consistent for both struggling and typical readers in both models. The ability to make inferences is a higher level thinking skill that requires readers to recall relevant information read and integrate it with new information read to draw conclusions.

Practical implications necessitate greater emphasis on explicit instruction on inference making. According to Marzano (2010), inference-making is a foundational thinking process that educators can foster in students by asking these four guiding questions: (1) What is my inference? (2) What information did I use to make this inference? (3) How good was my thinking? and (4) Do I need to change my thinking? These guiding questions can increase metacognition in students "to help them become more thoughtful in their inferences" (p. 81).

Motivation has yet to be substantiated as a direct influence on reading comprehension (e.g., Baker & Wigfield, 1999; Guthrie et al., 1999). In this study, there was no direct path from motivation to comprehension; however, when direct and indirect relationships were combined, motivation became the third largest contributor to reading comprehension (.186) in the MMRC. Motivation was significantly directly related to comprehension for typical readers (.171, $p < .05$), but not for those who struggle to read (-.043, $p > .05$). The findings suggest typical readers with higher motivation perform better on reading comprehension tasks, but that there is no direct relationship for struggling readers. In an effort to improve adolescent student motivation, the IES Practice Guide (Kamil et al., 2008) recommends four practices for educators to improve motivation among adolescent readers (p. 28-29):

- Establish meaningful and engaging content learning goals around the essential ideas of a discipline as well as the specific learning processes students use to access those ideas
- Provide a positive learning environment that promotes students' autonomy in learning
- Make literacy experiences more relevant to students' interests, everyday life, or important current events
- Build in certain instructional conditions, such as student goal setting, self-directed learning, and collaborative learning, to increase reading engagement and conceptual learning for students.

The complex relationships among multiple components of reading comprehension have yet to be fully explored. This study reported the relationships among background knowledge, inference-making, sentence comprehension fluency, vocabulary, and motivation with reading comprehension in a sample of 172 seventh- and eighth-graders. Despite the above listed limitations, this study offered a new reading comprehension model, extending the existing literature base.

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APPENDIX

STUDENT ASSENT

TEXAS A&M READING COMPREHENSION RESEARCH STUDY

STUDENT ASSENT FORM (ages 7-12)

Writing my name and signing this page means that the information about the study was read (by me/to me) and that I agree to be in the study. I know what will happen to me in the study. If I decide to quit the study, all I have to do is tell the person in charge.

____
Student Name (print)

______________________ ______________
Student Signature Date

______________________ ______________
Researcher Signature Date

Texas A&M University IRB Approval	From: 8/10/11	To: 6/17/12
IRB Protocol # 2010-0490	Authorized by: DG	

Version 02/15/2012

STUDENT INFORMATION SHEET

TEXAS A&M READING COMPREHENSION RESEARCH STUDY

You have been asked to participate in a research study to identify practices that help students like you understand the types of text you read in English language arts classes. We are conducting this study to test whether instructional practices improve students' reading comprehension.

If you agree to participate in this study, you will be asked to:

- Participate in small group or individual instruction where a university research team member teaches the instructional strategies. This will occur during your regular school hours.
- Participate in memory assessments and reading and reading comprehension assessments. These will take about 1 to 1.5 hours. They will be given during regular class times.
- Agree to be audio recorded when instructional practices are being taught.
- Allow demographic (age, gender) and state assessment data to be collected from the school.

This study will take place in the Spring, 2012 and will take approximately 2 weeks.

We hope this study helps your reading comprehension. Instruction will be similar to what you experience in daily classes except you will be taught in small groups or individually. This study should not cause you any harm. Your participation is voluntary. You may decide not to participate or to withdraw at any time by telling your teacher. This will not affect your class grade.

Any information obtained during the study will be kept strictly confidential. The information will be stored in a locked cabinet, kept in the project offices at Texas A&M University, and accessed only by research staff at Texas A&M or our research partners at The University of Texas at Austin, Florida State University, and other researchers in the future for research purposes not detailed within this consent form. Results from the study may be published in professional journals or presented at professional conferences, but no identifying information will be included. Your teacher or parent/guardian may request a copy of your results.

If you choose to participate in this study, you may be audio recorded during instruction. Any recordings will be stored securely and only research staff at Texas A&M, The University of Texas at Austin, and Florida State University will have access to the recordings. Recordings not used within 3 years will be destroyed.

If you would like to participate, sign the assent forms. You keep this information sheet.

Texas A&M University IRB Approval	From:	03-06-12	To: 06-17-12
IRB Protocol # 2010-0490		Authorized by: bz	

STUDENT ASSENT FORM (ages 13-17)

"I have read the description of the study titled ***TEXAS A&M READING COMPREHENSION RESEARCH STUDY*** and I understand what the procedures are and what will happen to me in the study. I agree to participate in this study. I know that I can quit the study at any time."

____
Student Name (print)

______________________________ ______________
Student Signature Date

______________________________ ______________
Signature of Researcher Date

Texas A&M University IRB Approval	From: 8/10/11	To: 6/17/12
IRB Protocol # 2010-0490	Authorized by: DC	